DOI:
10.3324/haematol.2019.238584

Document Version
Peer reviewed version

haematologica
Journal of The Ferrata Storti Foundation

Novel pyrrolobenzodiazepine benzofused hybrid molecules inhibit NF-κB activity and synergise with bortezomib and ibrutinib in hematological cancers

by Thomas Lewis, David B. Corcoran, David E. Thurston, Peter J. Giles, Kevin Ashelford, Elisabeth J. Walsby, Christopher D. Fegan, Andrea G.S. Pepper, Khondaker Miraz Rahman, and Chris Pepper

Haematologica 2020 [Epub ahead of print]

Citation: Thomas Lewis, David B. Corcoran, David E. Thurston, Peter J. Giles, Kevin Ashelford, Elisabeth J. Walsby, Christopher D. Fegan, Andrea G.S. Pepper, Khondaker Miraz Rahman, and Chris Pepper. Novel pyrrolobenzodiazepine benzofused hybrid molecules inhibit NF-κB activity and synergise with bortezomib and ibrutinib in hematological cancers.
Haematologica. 2020; 105:xxx
doi:10.3324/haematol.2019.238584

Novel pyrrolobenzodiazepine benzofused hybrid molecules inhibit NF-κB activity and synergise with bortezomib and ibrutinib in hematological cancers

Thomas Lewis[1], David B. Corcoran[2], David E. Thurston[2], Peter J. Giles[1,3], Kevin Ashelford[1,3], Elisabeth J. Walsby[1], Christopher D. Fegan[1], Andrea G. S. Pepper[4], Khondaker Miraz Rahman[2*] and Chris Pepper[1,4*]

[1]Division of Cancer & Genetics, Cardiff University School of Medicine, Heath Park, Cardiff, CF14 4XN, [2]School of Cancer and Pharmaceutical Science, King's College London, Franklin-Wilkins Building, 150 Stamford Street, London, SE1 9NH, [3]Wales Gene Park, Heath Park, Cardiff, CF14 4XN, [4]Brighton and Sussex Medical School, University of Sussex, Brighton, East Sussex, BN1 9PX.

**These authors contributed equally to this work*

Running title: Novel PBDs inhibit NF-κB in hematological cancers

Key words: pyrrolobenzodiazepine, multiple myeloma, chronic lymphocytic leukemia, NF-κB, synergy

Abstract word count: 218

Word count: 3322

Figures: 6

Corresponding author:
Professor Chris Pepper, Brighton and Sussex Medical School, University of Sussex, Brighton, East Sussex, BN1 9PX. Tel: 01273 678644 Email: c.pepper@bsms.ac.uk

Conflict of interests: All of the authors declare that they have no conflict of interests.

Abstract

Chronic lymphocytic leukemia (CLL) and multiple myeloma (MM) are incurable hematological malignancies that are pathologically linked with aberrant NF-κB activation. In this study, we identified a group of novel C8-linked benzofused Pyrrolo[2,1-*c*][1,4]benzodiazepines (PBD) monomeric hybrids capable of sequence-selective inhibition of NF-κB with low nanomolar LD_{50} values in CLL (n=46) and MM cell lines (n=5). The lead compound, DC-1-192, significantly inhibited NF-κB DNA binding after just 4h exposure and demonstrating inhibitory effects on both canonical and non-canonical NF-κB subunits. In primary CLL cells, sensitivity to DC-1-192 was inversely correlated with RelA subunit expression (r^2=0.2) and samples with BIRC3 or NOTCH1 mutations showed increased sensitivity (P=0.001). RNA-sequencing and gene set enrichment analysis confirmed the over-representation of NF-κB regulated genes in the down-regulated gene list. Furthermore, *In vivo* efficacy studies in NOD/SCID mice, using a systemic RPMI 8226 human multiple myeloma xenograft model, showed that DC-1-192 significantly prolonged survival (P=0.017). In addition, DC1-192 showed synergy with bortezomib and ibrutinib; synergy with ibrutinib was enhanced when CLL cells were co-cultured on CD40L-expressing fibroblasts in order to mimic the cytoprotective lymph node microenvironment (P = 0.01). Given that NF-κB plays a role in both bortezomib and ibrutinib resistance mechanisms, these data provide a strong rationale for the use of DC-1-192 in the treatment of NF-κB-driven cancers, particularly in the context of relapsed/refractory disease.

Introduction

Nuclear factor kappa B (NF-κB) denotes a family of homo- and heterodimeric transcription factors composed of five subunits: p65 (Rel A), p50, Rel B, p52 and c-Rel [1]. These subunits exert their effects via the canonical or non-canonical signaling pathways [2]. NF-κB is maintained in an inactive state in the cytoplasm but following IκB kinase (IKK) activation NF-κB is shuttled into the nucleus where it exerts its transcriptional effects [3]. NF-κB regulates the transcription of genes that are essential for cell survival, proliferation, inflammation and invasion/metastasis. These processes are commonly dysregulated in cancers, including CLL and MM, leading to the constitutive aberrant activation of NF-κB [2-4]. Indeed, NF-κB has been shown to play a central role in disease progression and drug resistance in these hematological cancers [5,6]. Whilst treatment with currently established therapies, such as the proteasome inhibitor bortezomib or the BTK inhibitor ibrutinib, are initially effective in a significant proportion of patients [7,8], there is evidence to suggest that treatment with both of these agents causes an increase in NF-κB activation which has been linked to drug resistance and treatment failure [9,10]. Therefore, direct inhibition of NF-κB could potentially resensitize tumor cells, thus highlighting this transcription factor as a potential therapeutic target [11-13].

Pyrrolo[2,1-*c*][1,4]benzodiazepines (PBDs) are naturally occurring molecules produced by *Streptomyces* bacteria whose family members include anthramycin (Figure 1) and tomaymycin [14,15]. PBDs are a class of sequence-specific covalent DNA minor groove binding agents that are selective for GC-rich sequences, which have recently been evaluated as potential chemotherapeutic agents in clinical trials

[16,17]. More recently, members of the PBD family have been developed as cytotoxic payloads for attachment to antibodies to form Antibody-Drug Conjugates (ADCs), and a number of these are currently undergoing clinical evaluation for the treatment of leukemia and lung cancer [18].

This study identified three lead compounds (DC-1-192, DC-1-92 and DC-1-170; Figure 1) from a library screen of 87 novel synthetic C8-linked benzofused PBD monomeric hybrids based on their *in vitro* cytotoxicity. The compounds were then further evaluated for their biological properties, including differential toxicity, in malignant and age-matched normal B- and T-cells. In terms of their mechanism of action, PBD monomers can recognise and bind to specific sequences of DNA and therefore have the potential to act as competitive inhibitors of transcription factors. Previous research has shown that PBD monomers such as GWL-78 preferentially inhibit the transcription factor NF-Y [19], whilst PBD monomers such as the DC-81-indole hybrid [20] and KMR-28-39 are potent NF-κB inhibitors [21]. The aim of this study was to determine the biological properties of these novel C8-linked benzofused PBD monomers by investigating their cytotoxic profiles in multiple myeloma cell lines, primary CLL cells and age-matched normal B- and T-lymphocytes. We went on to investigate their ability to inhibit NF-κB and whether they could potentiate the effects of the targeted agents bortezomib and ibrutinib, currently used in the treatment of myeloma and CLL, respectively.

Methods

Detailed methods can be found in Supplementary information.

Cell lines, primary CLL cells and normal lymphocytes

Primary chronic lymphocytic leukemia (CLL) cells (n=46) and age-matched normal B- and T-cells were obtained with informed consent in accordance with the ethical approval granted by South East Wales Research Ethics Committee (02/4806). In addition, five multiple myeloma cell lines, JJN3, U266, OPM2, MM.1S and H929 were obtained from DSMZ. The provenance of the cell lines was verified by multiplex PCR of minisatellite markers; all were certified mycoplasma-free.

Measurement of in vitro apoptosis

Apoptosis was assessed using Annexin V and propidium iodide labeling. Samples were analyzed using an Accuri C6 flow cytometer with CFlow software (BD Biosciences).

Enzyme Linked Immuno-sorbent Assay (ELISA) for NF-κB subunits

Nuclear levels of p65, p50, p52 and RelB DNA binding were assessed in JJN3 and U266 cells treated for 4h with DC-1-92, DC-1-170 (0nM-20nM) and DC-1-192 (0nM-5nM).

Synergy with bortezomib and ibrutinib

The synergy between the PBDs and bortezomib or ibrutinib was determined in the JJN3 cells and primary CLL cells respectively. Fixed molar ratios were derived from

experimentally-determined LD_{50} values for each PBD and clinically achievable concentrations of bortezomib and ibrutinib, respectively.

RNA Isolation and RNA-sequencing

JJN3 cells were treated with 20nM of either DC-1-170 or DC-1-192 for 4h. RNA was extracted using an RNeasy mini-kit (Qiagen) in accordance with the manufacturer's instructions. 100-900ng of high-quality total RNA (RNA integrity number >8) was depleted of ribosomal RNA, and the sequencing libraries were prepared using the Illumina TruSeq Stranded Total RNA with Ribo-Zero Gold™ kit (Illumina Inc.).

In vivo systemic xenograft model of myeloma in NOD/SCID mice

NOD/SCID mice were sub-lethally irradiated prior to tail vein inoculation with the human myeloma cell line RPMI8226 (1×10^7) to initiate tumor development. The date of inoculation was denoted as Day 0; intravenous treatment with vehicle only; 0.05% DMSO in saline (n=7) or 1mg/kg of DC-1-192 (n=7) was started at Day 5. Survival was evaluated from the first day of treatment until death.

Statistical Analysis

All statistical analysis was performed using Graphpad Prism 6.0 software (Graphpad Software). Normal distribution of the data was established using the omnibus K2 test. Univariate comparisons were made using the Student's *t*-test for paired and unpaired observations. All toxicity data from drug treatment were used to produce sigmoidal dose-response curves from which LD_{50} values were calculated. Toxicity data from synergy experiments were processed using CalcuSyn software using the

median effect method to subsequently calculate the combination index (CI) for each pair of agents; CI values less than 1 were indicative of synergy [22].

Results

Cytotoxic screening of PBD compounds identified three lead compounds

Initial cytotoxicity screening (trypan blue exclusion assay) of a library of 87 novel synthetic C8-linked benzofused PBD monomeric hybrids (PBDs) was carried out using the multiple myeloma cell line, JJN3. Three lead compounds were selected for further investigation based on their cytotoxic effects at nanomolar concentrations. The chemical structures of all three compounds, together with that of Anthramycin on which they are based, are shown in Figure 1.

In vitro and in vivo cytotoxicity of the lead PBD compounds in multiple myeloma cell lines

The relative cytotoxicity of the three lead compounds was then assessed in five different multiple myeloma cell lines, JJN3, U266, OPM2, MM.1S and H929 using an Annexin V/propidium iodide apoptosis assay. The cells were cultured for 48h in increasing concentrations (1nM-100nM) of DC-1-92, DC-1-170 and DC-1-192 and were compared with untreated controls. Each compound showed a dose-dependent increase in apoptosis; a representative example of the data generated is shown in Figure 2A. The dose-response curves for each compound were compared in each cell line using overlaid sigmoidal plots (Figure 2B) and the mean LD_{50} values were then calculated for each treatment and plotted on the bar chart shown in Figure 2C. Although each cell line showed differential sensitivity to the three compounds, in every case DC-1-192 was the most cytotoxic PBD with DC-1-170 showing the least cytotoxicity (Figure 2D). The LD_{50} values for DC-1-192 were compared

with the published NF-κB index value for each cell line [23]. The NF-κB index is the average of the log2 values for 10 NF-κB regulated genes (excluding BIRC3/cIAP2); the higher the index value, the more NF-κB-dependent the cell line is deemed to be. With the exception of JJN3 cells, sensitivity to DC-1-192 appeared to be inversely associated with the NF-κB index; a concept we went on to explore in subsequent experiments. In order to investigate the anti-tumor effects of DC-1-192 *in vivo*, we employed a systemic model of multiple myeloma in which NOD/SCID mice (two groups of seven mice) were inoculated with the human RPMI 8226 myeloma cell line ($1x10^7$ cells). Treatment was initiated 5 days after inocuation with either DC-1-192 (1mg/kg) or vehicle control. DC-1-192 was administered once per day (five days/week) for three weeks by intravenous injection and animals were monitored daily for morbidity and mortality. DC-1-192 significantly prolonged the survival of the mice; median survival in the DC-1-192-treated mice was 68 days versus 56 days in untreated mice (P = 0.017, HR = 2.98; Figure 2E).

Comparative cytotoxicity in primary CLL and normal B- and T-lymphocytes

Primary CLL cells and age-matched normal B- and T-lymphocytes obtained from healthy donors were treated with increasing concentrations of DC-1-92, DC-1-170 and DC-1-192. Apoptosis was measured using CD19/CD3/Annexin V labelling to determine the percentage of apoptosis induced by the PBDs in $CD19^+$ B-cells and $CD3^+$ T-cells as shown in Supplementary Figure 1A. Supplementary Figure 1B shows the comparative dose-responses for each of the cell types indicating that normal lymphocytes were less susceptible to the effects of the PBDs. As was the case with the three multiple myeloma cell lines, DC-1-192 was the most potent cytotoxic agent in primary CLL cells. Supplementary Figures 1C and 1D

show that CLL cells were significantly more sensitive to the effects of the PBDs when compared with age-matched normal B- and T-lymphocytes.

DC-1-192 shows preferential cytotoxicity in CLL cells carrying a NOTCH1 or BIRC3 mutation

All of the CLL samples treated with DC-1-192 (n= 46) showed nanomolar LD_{50} values with a mean LD_{50} value for the entire CLL cohort of 3.8nM (Figure 3A). We next examined whether sensitivity to DC-1-192 was associated with any of the known prognostic markers. There was no significant difference in mean LD_{50} value between *IGHV* mutated and *IGHV* unmutated samples (Figure 3B); CD38 positive and CD38 negative samples (≥/<20%) (Figure 3C) and beta2 microglobulin high and low samples (≥/<3.5mg/L)(Figure 3D). However, samples derived from patients with a BIRC3 (n=3) or NOTCH1 (n=11) mutation were significantly more sensitive to the effects of DC-1-192 (Figure 3E) suggesting that elevated NF-κB signalling may be a determinant of sensitivity [24, 25]. In keeping with this concept, the nuclear expression the NF-κB subunit p65 (RelA) was inversely correlated with DC-1-192 LD_{50} values (Figure 3F).

Nuclear localisation of NF-κB subunits following treatment with PBDs

We have previously shown that PBD monomers, such as KMR-28-39, have NF-κB inhibitory effects [21]. We, therefore, determined the NF-κB inhibitory properties of this new series of compounds in two myeloma cell lines JJN3 and U266. JJN3 cells overexpress both the canonical and non-canonical NF-κB subunits and possess an EFTUD2-NIK fusion gene which lacks the TRAF3 binding domain resulting in the accumulation of a cytoplasmic EFTUD2-NIK

fusion protein. U266 cells exhibit a TRAF3 mutation causing the stabilisation of wild-type NIK protein [23,24]. Both cell lines were treated for 4h with up to 20nM of each agent and the relative change in nuclear p65 (RelA), p50, p52 and RelB DNA binding was determined as a function of the untreated control. Levels of c-Rel were not evaluated in this study as JJN3 cells show very low levels of this subunit relative to the dominant canonical subunits p65 and p50. In JJN3 cells, all the PBDs showed significant inhibition of p65, p50 and Rel B but no significant reduction in p52 (Figure 4A). In contrast, U266 cells showed a significant reduction in the nuclear DNA binding of all four subunits (Figure 4B).

Transcriptional effects of DC-1-170 and DC-1-192 on JJN3 cells

As predicted, RNA-sequencing analysis of DC-1-170 and DC-1-192 revealed a dominant inhibitory effect on gene transcription with a smaller subset of genes showing increased transcription following exposure to the drug. In unsupervised hierarchical clustering, the samples clustered according to treatment condition (Figure 5A). Strikingly, 4040/5077 (80%) of the genes altered by exposure to the drugs were common to both PBD compounds (Figure 5B) suggesting that their structural similarity resulted in the inhibition of a conserved set of genes. Furthermore, Gene set enrichment analysis, using WebGestalt (WEB-based GEne SeT AnaLysis Toolkit)[25], confirmed that NF-κB regulated genes were significantly over-represented in the down-regulated gene list, with a normalised enrichment score of -1.7750 (Figures 5C and 5D). These data suggest that inhibition of NF-κB target genes may contribute to the cytotoxicity of these compounds.

Synergy between DC-1-192 in combination with bortezomib or ibrutinib

Over expression of NF-κB is associated with chemotherapeutic drug resistance in both CLL and multiple myeloma [26,27]. Having established that DC-1-192 inhibited nuclear NF-κB DNA binding and down-regulated NF-κB target genes, we set out to determine whether these inhibitory properties could enhance the killing effect of both bortezomib and ibrutinib in the JJN3 myeloma cell line and primary CLL cells, respectively. To investigate synergy, JJN3 and primary CLL cells (n = 5) were treated with increasing concentrations of DC-1-192 both alone and in combination with bortezomib in JJN3 cells and ibrutinib in CLL samples. The fixed molar ratios employed in the combination studies were determined experimentally using the LD_{50} values calculated from the previous toxicity data. The fraction affected plots and isobologram plots for the drugs and drug combinations in JJN3 cells (Figure 6A), and in primary CLL cells (Figure 6B) show that the cytotoxic effects of DC-1-192 are potentiated by the addition of bortezomib and ibrutinib, respectively. Furthermore, the combination of DC-1-192 with bortezomib and ibrutinib showed synergy (CI values <1) at the level of LD_{50}, LD_{75} and LD_{90} with an incremental increase in synergistic effect from LD_{50} to LD_{90} (Figure 6C). Furthermore, DC-1-192 showed increased synergy with ibrutinib when primary CLL cells were co-cultured on CD40L-expressing fibroblasts (Figure 6D) suggesting that these agents may be particularly effective in the treatment of tissue resident CLL cells.

Discussion

NF-κB is a master regulator of a number of cellular processes that contribute to cancer progression including cell survival and proliferation. Furthermore, it is often implicated in drug resistance, highlighting its potential as a therapeutic target [12,13]. The interest in small molecular DNA-binding agents, such as the PBD

monomers, has increased in recent years due to their ability to selectively bind to specific sequences within the minor groove of DNA; a characteristic that separates them from traditional alkylating agents. This raises the possibility that they can selectively inhibit transcription factors [16], so this study set out to determine the *in vitro* and *in vivo* biological effects of a series of novel C8-linked PBD-benzofused hybrids.

Initially library screening identified three lead compounds. All three PBDs showed high potency in five different multiple myeloma cell lines with LD_{50} values in the low nanomolar range. Subsequently, the PBDs showed similar high potency in a cohort of 46 primary chronic lymphocytic leukemia samples and significantly lower toxicity in normal age-matched B- and T-lymphocytes. The most cytotoxic PBD, DC-1-192, showed a 2.4-fold and 4.6-fold differential toxicity in CLL cells suggesting that this compound has a positive therapeutic index. We went on to show that DC-1-192 was well tolerated in a systemic *in vivo* xenograft model of myeloma and significantly prolonged the survival of the mice.

Subset analysis of the CLL cohort data revealed that DC-1-192 was equipotent in poor prognostic groups including *IGHV* unmutated cases (P=0.96). Furthermore, samples derived from patients with BIRC3 or NOTCH1 mutations showed significantly increased sensitivity to DC-1-192. These mutations are known to cause aberrant activation of NF-κB signaling and are associated with resistance to chemoimmunotherapy and inferior clinical outcome [28-32]. Although these mutations are linked with non-canonical NF-κB activation, here we showed that

nuclear expression of the canonical p65 subunit was a predictor of *in vitro* sensitivity to DC-1-192.

Given these findings, we plotted the previously published NF-κB index for each of the myeloma cell lines [23] against their respective LD_{50} for DC-1-192. 4/5 of the cell lines showed an inverse relationship between their NF-κB index and DC-1-192 LD_{50} value suggesting that response to DC-1-192 was influenced by how NF-κB-dependent the cell lines were. JJN3 cells were the exception to this rule; these cells manifest a high NF-κB index (10.8) but were relatively resistant than the other four cell lines to the cytotoxic effects of DC-1-192 (mean LD_{50} = 6nM). The reasons for this are likely to be multiple and may be unrelated to NF-κB, but it is worthy of note that JJN3 cells possess a cytoplasmic EFTUD2-NIK fusion gene, which may alter p100 processing to p52. Indeed, when we assessed the impact of the PBDs on nuclear NF-κB subunit DNA binding in JJN3 cells, all three compounds showed significant inhibition of the p65 and p50 canonical subunits as well as the non-canonical subunit RelB after 4h. In contrast, no significant change in p52 was observed following treatment with the PBDs. We subsequently repeated the experiments using the U266 cell line, which has a TRAF3 mutation leading to the cytoplasmic accumulation of NF-κB inducing kinase (NIK) [23,24]. These cells showed a significant reduction in all four NF-κB subunits including p52 following short-term treatment with PBDs.

The rapid reduction in nuclear NF-κB subunit expression indicates that NF-κB inhibition precedes apoptosis in these cells and may to contribute to the efficacy of the PBDs. Given the DNA binding charctaeristics of these compounds, it seems

possible that they compete for NF-κB binding motifs, thereby inhibiting the transcription of NF-κB target genes. The reduction in nuclear NF-κB subunits observed in this study may be caused by the shuttling of unbound NF-κB back to the cytoplasm and/or targeted degradation [33,34].

Activation of NF-κB has also been implicated in the development of chemotherapeutic drug resistance in myeloma and CLL [35]. Several DNA damaging agents, including melphalan and fludarabine, have been shown to induce the activity of NF-κB, thereby contributing to cellular resistance to the cytotoxic effects of these treatments [6,36]. In myeloma, bortezomib has been shown to re-sensitise malignant cells to the effects of chemotherapy [37]. However, the emergence of a bortezomib-resistant sub-clones ultimately leads to relapse in many patients [38]. One putative mechanism of bortezomib resistance is the constitutive expression of NF-κB. Although bortezomib can prevent *de novo* activation of the canonical pathway, it has no significant effect on constitutive NF-κB activity [27]. In this study, we showed that direct competitive inhibition of NF-κB at the site of transcription led to the re-sensitisation of multiple myeloma cells to the effects of bortezomib. This synergistic effect is likely to be multi-factorial, but indicates that bortezomib and the PBDs have different molecular targets.

Similarly, in CLL bruton's tyrosine kinase (BTK) has been shown to be a critical downstream mediator of BCR signaling that is often constitutively activated in CLL patients. The targeting of this kinase with the BTK inhibitor, ibrutinib has shown notable effects in patients with relapsed CLL [39,40] and this is mediated, at least in

part, by the distal inhibition of NF-κB [41]. However, emerging evidence of resistance mechanisms to ibrutinib strongly implicate NF-κB [42]. Here, we show that the combination of DC-1-192 with ibrutinib produced cytotoxic synergy suggesting that the PBDs and ibrutinib target NF-κB through different mechanisms and/or that they have other, non-overlapping, molecular targets. Furthermore, synergy was enhanced when primary CLL cells were co-cultured on CD40L-expressing fibroblasts in order to mimic the lymph node microenvironment. This suggests that PBDs may be particularly useful in targeting tissue resident tumor cells.

In summary, the novel PBDs evaluated in this study showed low nanomolar toxicity in both primary CLL cells and myeloma cell lines. In addition, primary CLL cells carrying BIRC3 or NOTCH1 mutations were preferentially sensitive to the cytotoxic effects of DC-1-192 suggesting that this agent may be a potential therapeutic option for these poor risk subsets. Mechanistically, the PBDs demonstrated promising dual inhibitory properties on both the canonical and non-canonical NF-κB pathways; a characteristic that has been previously linked to significant anti-tumor effects in multiple myeloma [43]. Furthermore, the PBDs showed *in vitro* synergy with bortezomib and ibrutinib in MM and CLL respectively, providing a strong rationale for the use of these agents in the treatment of relapsed/refractory B-cell neoplasms.

Acknowledgements

This work was supported by a grant (No. 12-1263/JGATCBR) from Worldwide Cancer Research (formerly AICR) to DET, KMR and CP in 2012. This support included a PhD

studentship held by DBC, which enabled all of the novel medicinal chemistry. CP, CDF and AGSP are also supported by a Bloodwise Programme Continuity Grant (18005).

Author contributions

TL performed experiments, analysed data and drafted the manuscript. DBC performed experiments, analysed data and revised the manuscript. KMR and DET conceived and supervised the synthetic chemistry and revised the mansucript, PJG, KA and AGSP analysed data and revised the manuscript. EJW analysed data and revised the manuscript. CDF provided vital reagents and revised the manuscript. CP conceived and supervised the cell biology experiments, analysed data and revised the manuscript.

Conflict of interest

All of the authors declare that they have no material conflict of interests.

References

1. Zheng C, Yin Q, Wu H. Structural studies of NF-κB signaling. Cell Res. 2011;21(1):183-195.
2. Gasparini C, Celeghini C, Monasta L, Zauli G. NF-κB pathways in hematological malignancies. Cell Mol Life Sci. 2014;71(11):2083-2102.
3. Hoffmann A, Natoli G, Ghosh G. Transcriptional regulation via the NF-kappaB signaling module. Oncogene. 2006;25(51):6706-6716.
4. Braun T, Carvalho G, Fabre C, Grosjean J, Fenaux P, Kroemer G. Targeting NF-kappaB in hematologic malignancies. Cell Death Differ. 2006;13(5):748-758.
5. Abdi J, Chen G, Chang H. Drug resistance in multiple myeloma: latest findings and new concepts on molecular mechanisms. Oncotarget. 2013;4(12):2186-2207.
6. Hewamana S, Alghazal S, Lin TT, et al. The NF-kappaB subunit Rel A is associated with in vitro survival and clinical disease progression in chronic lymphocytic leukemia and represents a promising therapeutic target. Blood. 2008;111(9):4681-4689.

7. Merchionne F, Perosa F, Dammacco F. New therapies in multiple myeloma. Clin Exp Med. 2007;7(3):83-97.
8. Byrd JC, Brown JR, O'Brien S, et al. RESONATE Investigators. Ibrutinib versus ofatumumab in previously treated chronic lymphoid leukemia. N Engl J Med. 2014;371(3):213-223.
9. Hideshima T, Ikeda H, Chauhan D, et al. Bortezomib induces canonical nuclear factor-kappaB activation in multiple myeloma cells. Blood. 2009;114(5):1046-1052.
10. Ahn IE, Underbayev C, Albitar A, et al. Clonal evolution leading to ibrutinib resistance in chronic lymphocytic leukemia. Blood. 2017;129(11):1469-1479.
11. Wang CY, Mayo MW, Baldwin AS. TNF- and cancer therapy-induced apoptosis: potentiation by inhibition of NF-kappaB. Science. 1996;274(5288):784-787.
12. Hideshima T, Chauhan D, Richardson P, et al. NF-kappa B as a therapeutic target in multiple myeloma. J Biol Chem. 2002;277(19):16639-16647.
13. Pepper C, Hewamana S, Brennan P, Fegan C. NF-kappaB as a prognostic marker and therapeutic target in chronic lymphocytic leukemia. Future Oncol. 2009;5(7):1027-1037.
14. Antonow D, Thurston DE. Synthesis of DNA-interactive pyrrolo[2,1-c [1,4]benzodiazepines (PBDs). Chem Rev. 2011;111(4):2815-2864.
15. Gerratana B. Biosynthesis, synthesis, and biological activities of pyrrolobenzodiazepines. Med Res Rev. 2012;32(2):254-293.
16. Rahman KM, Vassoler H, James CH, Thurston DE. DNA Sequence Preference and Adduct Orientation of Pyrrolo[2,1-c][1,4]benzodiazepine Antitumor Agents. ACS Med Chem Lett. 2010;1(8):427-432.
17. Puzanov I, Lee W, Chen AP, et al. Phase I pharmacokinetic and pharmacodynamic study of SJG-136, a novel DNA sequence selective minor groove cross-linking agent, in advanced solid tumors. Clin Cancer Res. 2011;17(11):3794-3802.
18. Mantaj J, Jackson PJ, Rahman KM, Thurston DE. From Anthramycin to Pyrrolobenzodiazepine (PBD)-Containing Antibody-Drug Conjugates (ADCs). Angew Chem Int Ed Engl. 2017;56(2):462-488.
19. Kotecha M, Kluza J, Wells G, et al. Inhibition of DNA binding of the NF-Y transcription factor by the pyrrolobenzodiazepine-polyamide conjugate GWL-78. Mol Cancer Ther. 2008;7(5):1319-1328.
20. Hu WP, Tsai FY, Yu HS, Sung PJ, Chang LS, Wang JJ. Induction of apoptosis by DC-81-indole conjugate agent through NF-kappaB and JNK/AP-1 pathway. Chem Res Toxicol. 2008;21(7):1330-1336.
21. Rahman KM, Jackson PJ, James CH, et al. GC-targeted C8-linked pyrrolobenzodiazepine-biaryl conjugates with femtomolar in vitro cytotoxicity and in vivo antitumor activity in mouse models. J Med Chem. 2013;56(7):2911-2935.
22. Chou TC. Drug combination studies and their synergy quantification using the Chou-Talalay method. Cancer Res. 2010;70(2):440-446.
23. Demchenko YN, Glebov OK, Zingone A, Keats JJ, Bergsagel PL, Kuehl WM. Classical and/or alternative NF-kappaB pathway activation in multiple myeloma. Blood. 2010;115(17):3541-3552.

24. Keats JJ, Fonseca R, Chesi M, et al. Promiscuous mutations activate the noncanonical NF-kappaB pathway in multiple myeloma. Cancer Cell. 2007;12(2):131-144.
25. Zhang B, Kirov S, Snoddy J.WebGestalt: an integrated system for exploring gene sets in various biological contexts. Nucleic Acids Res. 2005;33(Web Server issue):W741-48.
26. Hertlein E, Byrd JC. Signalling to drug resistance in CLL. Best Pract Res Clin Haematol. 2010;23(1):121-131.
27. Markovina S, Callander NS, O'Connor SL, et al. Bortezomib-resistant nuclear factor-kappaB activity in multiple myeloma cells. Mol Cancer Res. 2008;6(8):1356-1364.
28. Diop F, Moia R, Favini C, et al. Biological and clinical implications of BIRC3 mutations in chronic lymphocytic leukemia. Haematologica. 2020;105(2):448-456.
29. Benedetti D, Tissino E, Pozzo F, et al. NOTCH1 mutations are associated with high CD49d expression in chronic lymphocytic leukemia: link between the NOTCH1 and the NF-κB pathways. Leukemia. 2018;32(3):654-662.
30. Asslaber D, Wacht N, Leisch M, Qi Y, et al. BIRC3 Expression Predicts CLL Progression and Defines Treatment Sensitivity via Enhanced NF-κB Nuclear Translocation. Clin Cancer Res. 2019;25(6):1901-1912
31. Del Poeta G, Dal Bo M, Del Principe MI, et al. Clinical significance of c.7544-7545 del CT NOTCH1 mutation in chronic lymphocytic leukaemia. Br J Haematol. 2013; 160(3):415-418.
32. Rossi D, Rasi S, Fabbri G, et al. Mutations of NOTCH1 are an independent predictor of survival in chronic lymphocytic leukemia. Blood. 2012; 119(2):521.
33. Hoffmann A, Levchenko A, Scott ML, Baltimore D. The IkappaB-NF-kappaB signaling module: temporal control and selective gene activation. Science. 2002;298(5596):1241-1245.
34. Natoli G, Chiocca S. Nuclear ubiquitin ligases, NF-kappaB degradation, and the control of inflammation. Sci Signal. 2008;1(1):pe1.
35. Godwin P, Baird AM, Heavey S, Barr MP, O'Byrne KJ, Gately K. Targeting nuclear factor-kappa B to overcome resistance to chemotherapy. Front Oncol. 2013;3:120.
36. Baumann P, Mandl-Weber S, Oduncu F, Schmidmaier R. Alkylating agents induce activation of NFkappaB in multiple myeloma cells. Leuk Res. 2008;32(7):1144-1147.
37. San Miguel JF, Schlag R, Khuageva NK, et al. Bortezomib plus melphalan and prednisone for initial treatment of multiple myeloma. N Engl J Med. 2008;359(9):906-917.
38. Murray MY, Auger MJ, Bowles KM. Overcoming bortezomib resistance in 548 multiple myeloma. Biochem Soc Trans. 2014;42(4):804-808.
39. Woyach JA, Bojnik E, Ruppert AS, et al. Bruton's tyrosine kinase (BTK) function is important to the development and expansion of chronic lymphocytic leukemia (CLL). Blood. 2014;123(8):1207-1213.
40. Byrd JC, Furman RR, Coutre SE, et al. Targeting BTK with ibrutinib in relapsed chronic lymphocytic leukemia. N Engl J Med. 2013;369(1):32-42.

41. Herman SE, Mustafa RZ, Gyamfi JA, et al. Ibrutinib inhibits BCR and NF-κB signaling and reduces tumor proliferation in tissue-resident cells of patients with CLL. Blood. 2014;123(21):3286-3295.
42. Jayappa KD, Portell CA, Gordon VL, et al. Microenvironmental agonists generate de novo phenotypic resistance to combined ibrutinib plus venetoclax in CLL and MCL. Blood Adv. 2017;1(14):933-946.
43. Fabre C, Mimura N, Bobb K, et al. Dual inhibition of canonical and noncanonical NF-κB pathways demonstrates significant antitumor activities in multiple myeloma. Clin Cancer Res. 2012;18(17):4669-4681.

Figure Legends

Figure 1. The structures of Anthramycin and three structurally-related C8-linked benzofused PBD hybrids. Anthramycin (the first PBD to be isolated from a Streptomyces species), and the three synthetic PBDs, DC-1-192, DC-1-92 and DC-1-170, identified as lead compounds in this study.

Figure 2. PBDs induce apoptosis in multiple myeloma cell lines in a dose-dependent manner. **(A)** An example of Annexin V and propidium iodide bivariate plots obtained from JJN3 cells treated with increasing concentrations of DC-1-92. A dose-dependent increase in the proportion of Annexin V^+/PI^- and Annexin V^+/PI^+ was observed. **(B)** Sigmoidal dose-response curves illustrating the comparative effects of each compound in U266, OPM2, H929, JJN3 and MM1.S multiple myeloma cell lines. **(C)** Comparative analysis of the three lead PBDs in the five multiple myeloma cell lines revealed significant differential sensitivity to each compound and between each cell line but DC-1-192 was the most potent PBD in all five cell lines **(D)** shows the relationship between the NF-κB index of each of the cell lines with their respective mean DC-1-192 LD_{50} value. **(E)** In order to investigate the *in vivo* anti-tumor effects of DC-1-192, NOD/SCID mice were systemically inoculated with the human RPMI 8226 myeloma cell line. DC-1-192 (1mg/kg) significantly prolonged the survival of the mice when compared to untreated control mice. All *in vitro* experiments were performed in triplicate and data are presented as mean ± SD. The *in vivo* experiment was performed in treated and untreated mice (n=7 for each group).

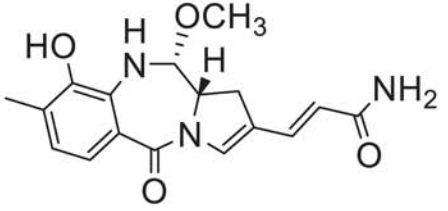
Figure 3. DC-1-192 was highly cytotoxic in primary CLL cells and showed preferential effects in BIRC3 and NOTCH1 mutated samples. (A) All 46 samples tested showed low nanomolar LD_{50} values when treated with DC-1-192. Analysis of prognostic subsets revealed that DC-1-192 was equipotent in **(B)** *IGHV* mutated and unmutated samples, **(C)** CD38 positive and CD38 negative samples and **(D)** beta2 microglobulin high and low samples. **(E)** In contrast, BIRC3 and NOTCH1 mutated samples showed significantly increased sensitivity to DC-1-192. **(F)** There was an inverse relationship between nuclear DNA binding of the canonical NF-κB subunit, p65, and DC-1-192 LD_{50} values.

Figure 4. PBDs show marked inhibitory effects on both canonical and non-canonical NF-κB subunits. JJN3 and U266 cells were treated with DC-1-92, DC-1-170 and DC-1-192 for 4 hours, nuclear extracts were then generated from these samples and the amount of p65,

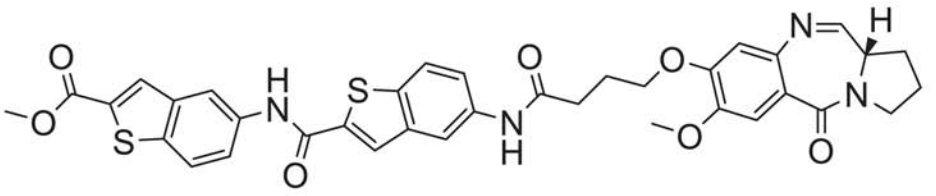
p50, p52 and Rel B was quantified and expressed relative fold change as a function of the untreated controls. **(A)** JJN3 cells showed significant reductions in nuclear expression p65, p50 and Rel B NF-κB subunits but no change in p52 following exposure to DC-1-92, DC-1-170 and DC-1-192. **(B)** In contrast, U266 cells showed significant reductions in nuclear expression of all four NF-κB subunits. All experiments were performed in triplicate. P-values: *<0.05, **<0.01, ***<0.001 and ****<0.0001. ns denotes changes that were not statistically significant.

Figure 5. RNA sequencing and gene set enrichment analysis revealed that DC-1-170 and DC-1-192 preferentially inhibited NF-κB target genes. (A) Unsupervised hierarchical clustering revealed a strong drug-associated transcriptional signature for both DC-1-170 and DC-1-192. **(B)** The majority of of the significantly altered transcripts were down-regulated in response to drug 4418/5077 (87%). Strikingly, 4040/5077 (80%) of the changes were common to both DC-1-170 and DC-1-192. Both **(C)** Gene set enrichment analysis showed over representation of NF-κB target genes in the gene list commonly down-regulated by exposure to DC-1-170 and DC-1-192. **(D)** Shows the top 12 over-represented pathways in the commonly down-regulated gene list following exposure to DC-1-170 and DC-1-192. The table also shows the normalized enrichment scores, p-values and false dicovery rates for each canonical gene set.

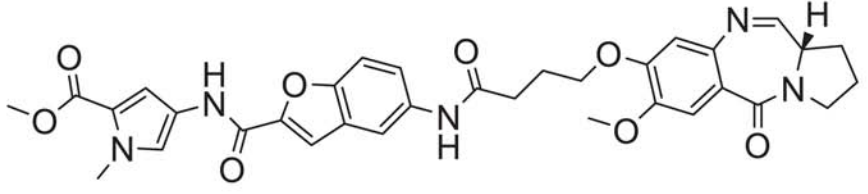
Figure 6. DC-1-192 demonstrates cytotoxic synergy with bortezomib and ibrutinib. Synergy between DC-1-192 and bortezomib was experimentaly determined in JJN3 cells and between DC-1-192 and ibrutinib in primary CLL cells. The fixed molar ratios for each combination were derived from the mean LD_{50} values for DC-1-192 and the clinically achievable doses of bortezomib and ibrutinib. Apoptosis was determined using the Annexin V/PI assay. **(A)** The fraction affected plot and the isobologram plot for DC-1-192, bortezomib and their respective combination (1:15) in JJN3 cells. **(B)** The fraction affected plot and isobologram plot for DC-1-192, ibrutinib and their combination (1:3000) in primary cells. **(C)** The combination indices for the combination DC-1-192 with bortezomib and DC-1-192 with Ibrutinib at the level of LD_{50}, LD_{75} and LD_{90} in primary CLL cells (n = 5). **(D)** Comparison of the combination indices generated by the combination of DC-1-192 and ibrutinib in monoculture and CD40L-expressing co-culture. All JJN3 cell line experiments were performed in triplicate. All of the primary CLL experiments were performed on samples derived from 5 individual patients with data presented as the mean of duplicate experiments.



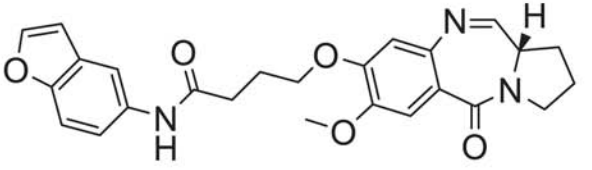
Anthramycin Methyl Ether



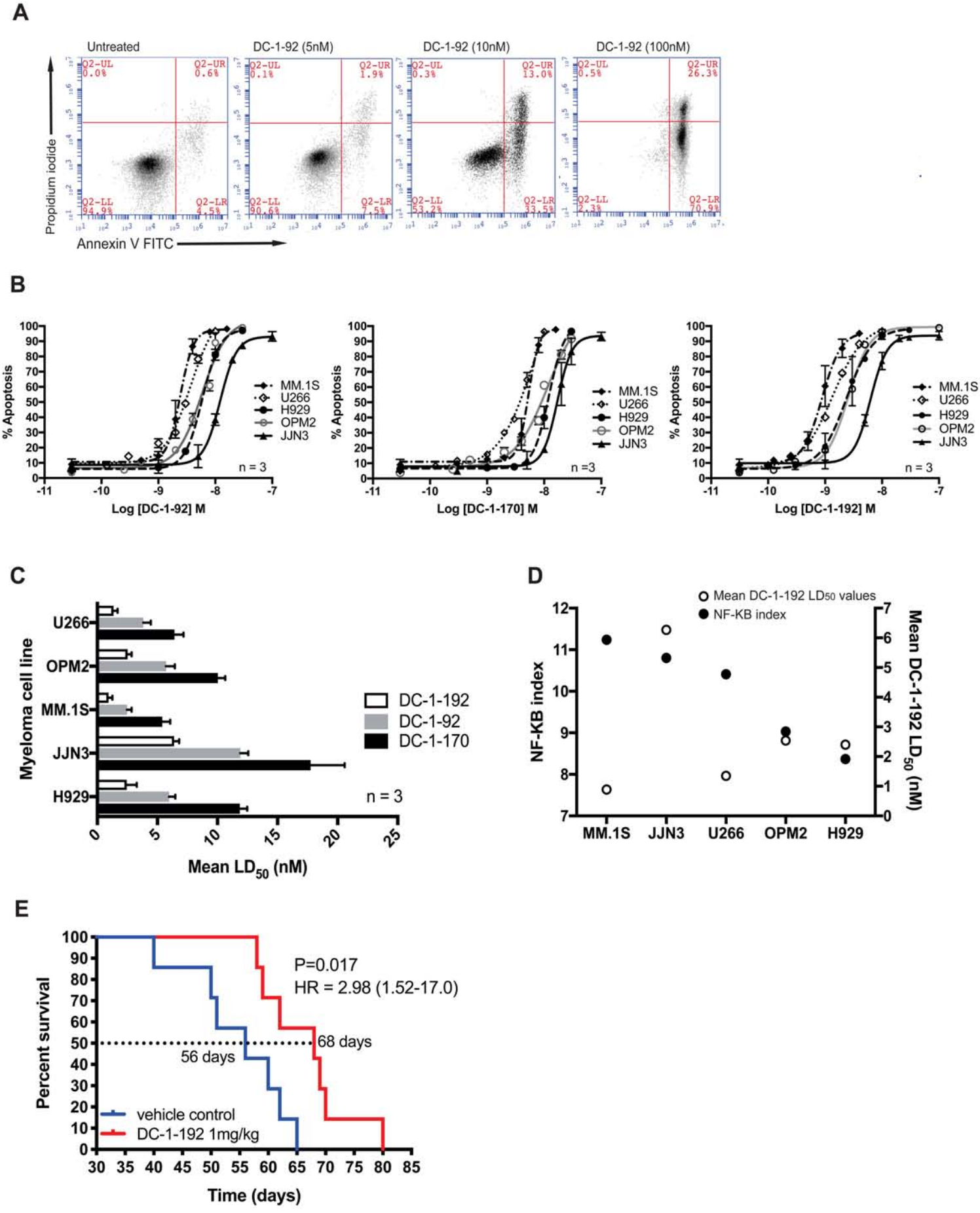
DC-1-192

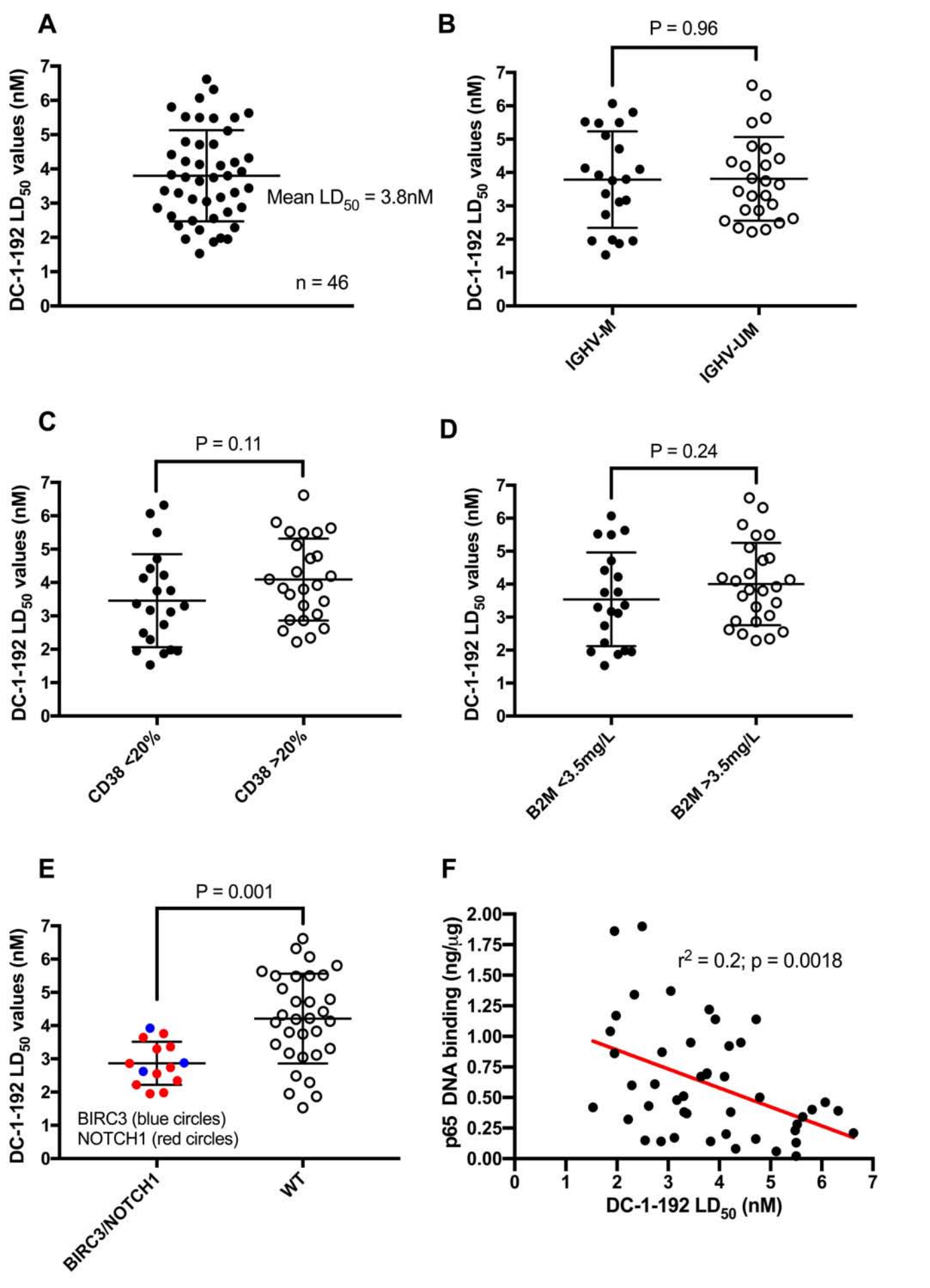


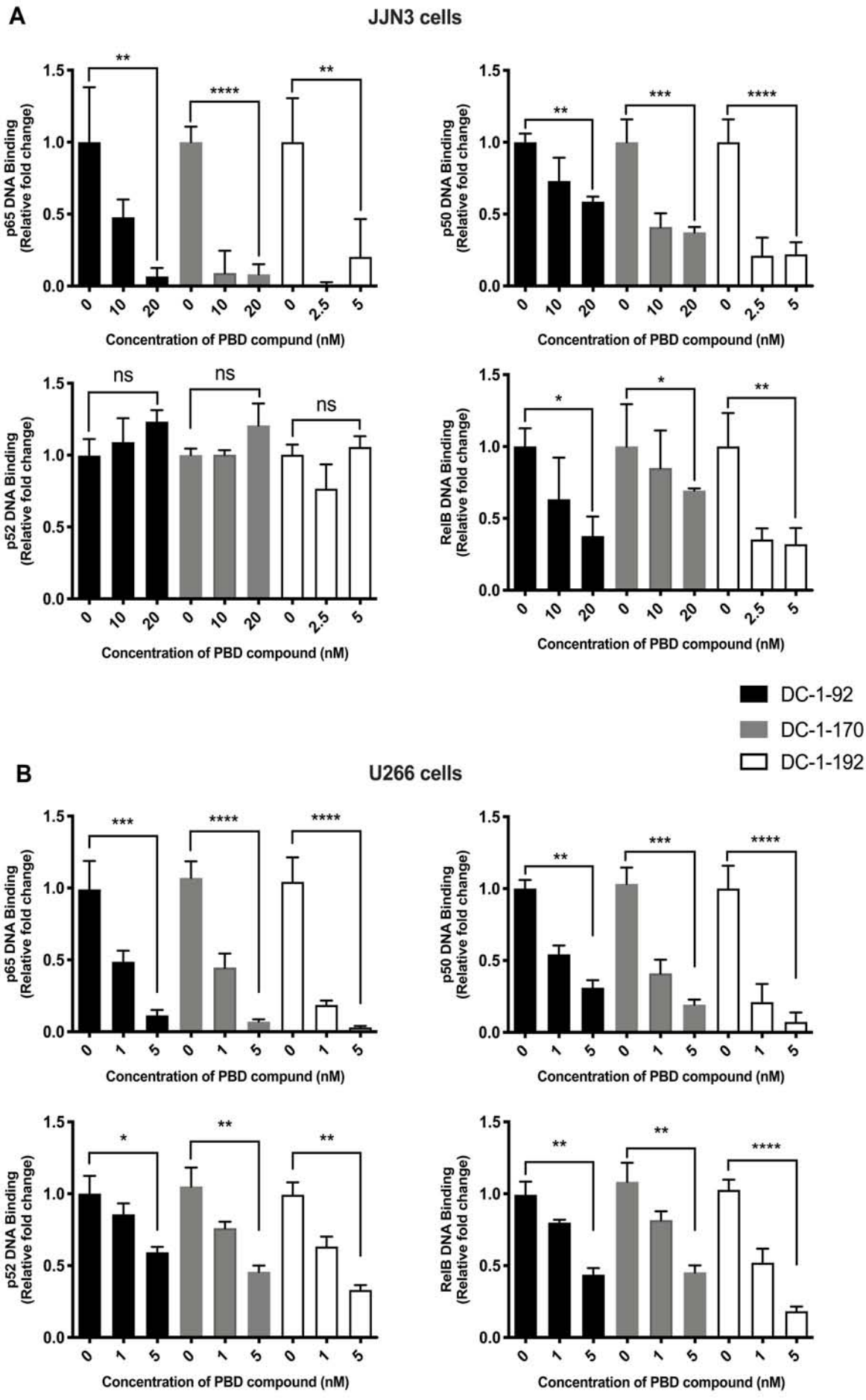
DC-1-92



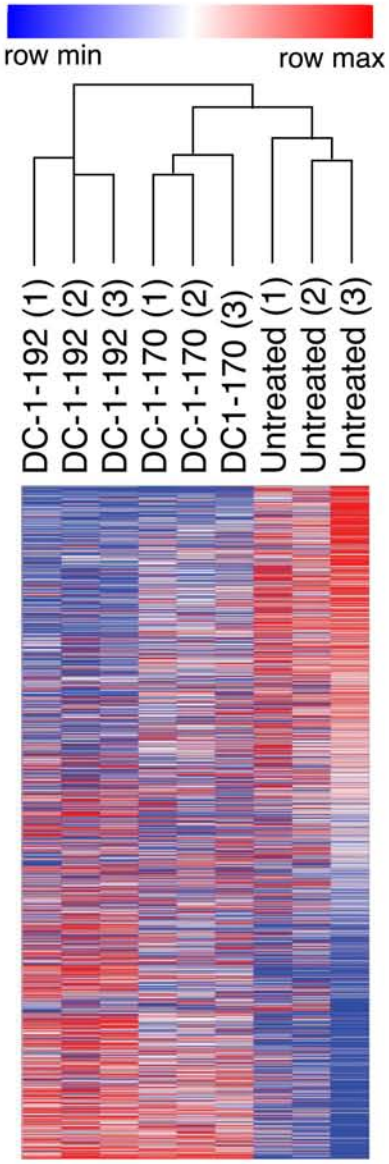
DC-1-170


A
Untreated
DC-1-92 (5nM)
DC-1-92 (10nM)
DC-1-92 (100nM)
Propidium iodide
Annexin V FITC
B
% Apoptosis
Log [DC-1-92] M
Log [DC-1-170] M
Log [DC-1-192] M
MM.1S
U266
H929
OPM2
JJN3
n = 3
C
Myeloma cell line
U266
OPM2
MM.1S
JJN3
H929
DC-1-192
DC-1-92
DC-1-170
n = 3
Mean LD50 (nM)
D
Mean DC-1-192 LD50 values
NF-KB index
NF-KB index
Mean DC-1-192 LD50 (nM)
MM.1S
JJN3
U266
OPM2
H929
E
Percent survival
P=0.017
HR = 2.98 (1.52-17.0)
68 days
56 days
vehicle control
DC-1-192 1mg/kg
Time (days)

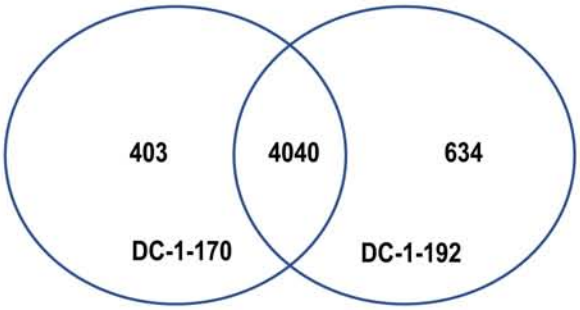

A
DC-1-192 LD50 values (nM)
Mean LD50 = 3.8nM
n = 46
B
P = 0.96
DC-1-192 LD50 values (nM)
IGHV-M
IGHV-UM
C
P = 0.11
DC-1-192 LD50 values (nM)
CD38 <20%
CD38 >20%
D
P = 0.24
DC-1-192 LD50 values (nM)
B2M <3.5mg/L
B2M >3.5mg/L
E
P = 0.001
DC-1-192 LD50 values (nM)
BIRC3 (blue circles)
NOTCH1 (red circles)
BIRC3/NOTCH1
WT
F
r2 = 0.2; p = 0.0018
p65 DNA binding (ng/μg)
DC-1-192 LD50 (nM)


A
JJN3 cells
p65 DNA Binding (Relative fold change)
p50 DNA Binding (Relative fold change)
p52 DNA Binding (Relative fold change)
RelB DNA Binding (Relative fold change)
Concentration of PBD compound (nM)
ns
DC-1-92
DC-1-170
DC-1-192
B
U266 cells

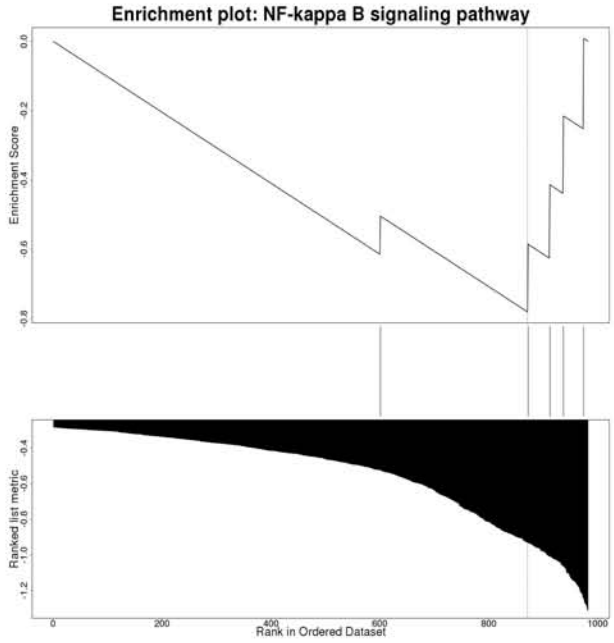
A



B

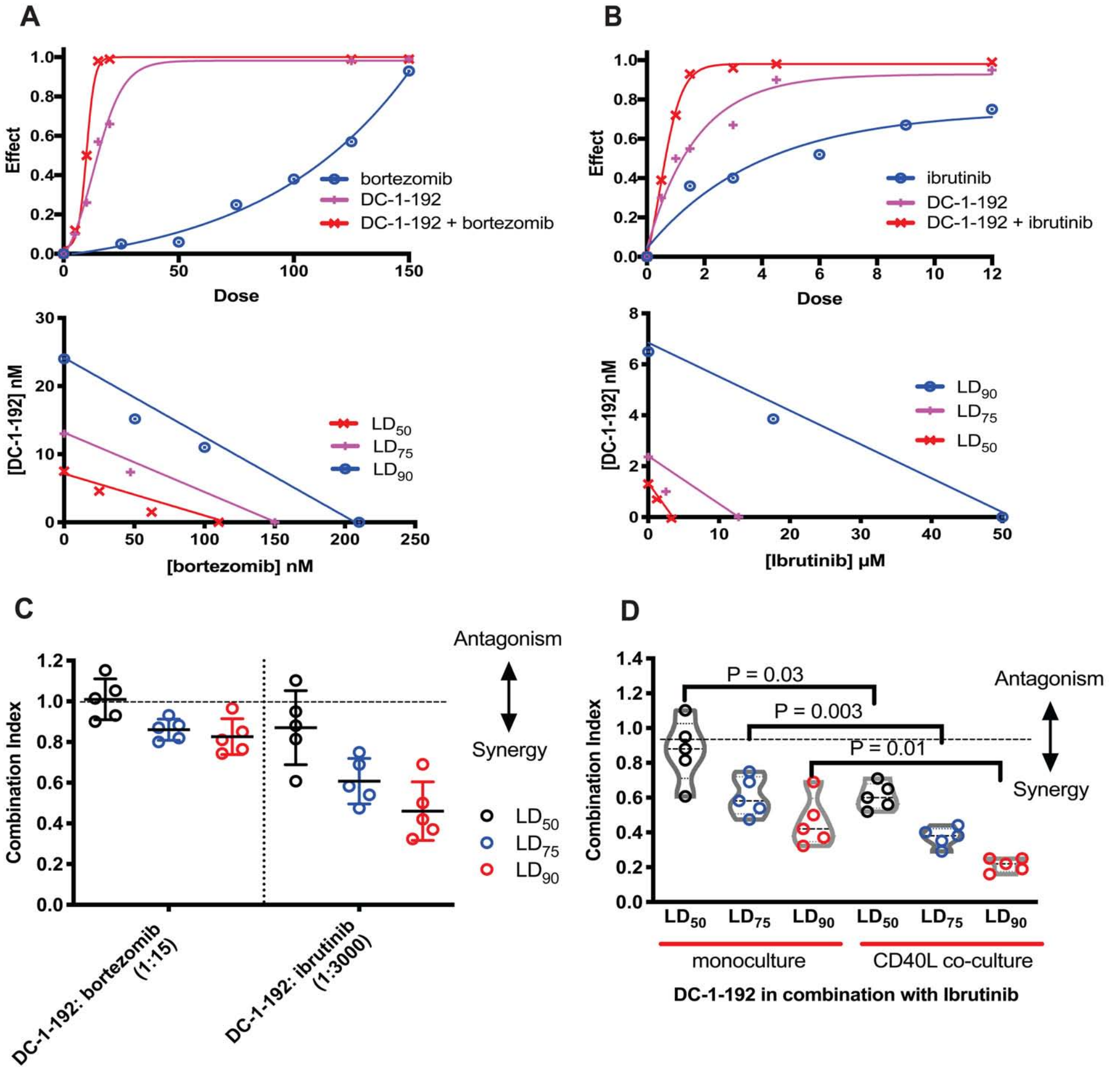


C



D

GeneSet	Description	Enrichment Score	Normalized Enrichment Score	p-value	FDR
hsa04630	JAK-STAT signaling pathway	-0.6824	-1.9718	0.0012	0.0725
hsa05222	Small cell lung cancer	-0.7432	-1.7127	0.0013	0.1986
hsa04640	Hematopoietic cell lineage	-0.7257	-1.8594	0.0024	0.0642
hsa04064	NF-kappa B signaling pathway	-0.7806	-1.7750	0.0026	0.1348
hsa04080	Neuroactive ligand-receptor interaction	-0.5484	-1.8622	0.0053	0.0785
hsa05323	Rheumatoid arthritis	-0.6686	-1.7070	0.0062	0.1831
hsa04727	GABAergic synapse	-0.6176	-1.6455	0.0144	0.2779
hsa05133	Pertussis	-0.6619	-1.6262	0.0280	0.2904
hsa04150	mTOR signaling pathway	0.2546	1.0526	0.3760	0.6415
hsa05231	Choline metabolism in cancer	0.3838	1.0528	0.3765	0.6835
hsa00270	Cysteine and methionine metabolism	0.3715	1.0227	0.3816	0.6622
hsa04662	B cell receptor signaling pathway	0.2764	1.0024	0.4237	0.6656


A
Effect
Dose
bortezomib
DC-1-192
DC-1-192 + bortezomib
[DC-1-192] nM
[bortezomib] nM
LD50
LD75
LD90
B
Effect
Dose
ibrutinib
DC-1-192
DC-1-192 + ibrutinib
[DC-1-192] nM
[Ibrutinib] µM
LD90
LD75
LD50
C
Combination Index
Antagonism
Synergy
LD50
LD75
LD90
DC-1-192: bortezomib (1:15)
DC-1-192: ibrutinib (1:3000)
D
Combination Index
P = 0.03
P = 0.003
P = 0.01
Antagonism
Synergy
LD50
LD75
LD90
LD50
LD75
LD90
monoculture
CD40L co-culture
DC-1-192 in combination with Ibrutinib

Methods

Culture conditions for cell lines, primary CLL cells and normal lymphocytes

Primary chronic lymphocytic leukemia (CLL) cells were obtained from patients attending outpatients' clinics at the University Hospital of Wales with informed consent in accordance with the ethical approval granted by South East Wales Research Ethics Committee (02/4806). Age-matched normal B- and T-cells were obtained from healthy volunteers again with informed consent. Five multiple myeloma cell lines, JJN3, U266, OPM2, MM.1S and H929, were maintained in liquid culture at densities ranging between 0.5-2x10^6 cells/ml. JJN3 cells were maintained in DMEM media containing 20% fetal bovine serum (FBS), 1% sodium pyruvate and 1% penicillin and streptomycin. U266, OPM2, MM.1S and H929 cells were maintained in RPMI media containing 20% FBS, 1% L-glutamate and 1% penicillin and streptomycin. All cell lines were purchased from DSMZ and were used for these experiments within 6 months of purchase. In each case, the provenance of the cell lines was verified by multiplex PCR of minisatellite markers, and all were certified mycoplasma-free. In terms of NF-κB mutations, JJN3 cells possess an EFTUD2-NIK fusion gene which lacks the TRAF3 binding domain resulting in the accumulation of a cytoplasmic EFTUD2-NIK fusion protein. MM.1S and U266 cells exhibit TRAF3 mutations resulting in the stabilisation of wild-type NIK protein. H929 and OPM2 cells do not have any NF-κB-related mutations. In terms of their reliance on NF-κB signaling, MM.1S cells exhibit the highest NF-κB index followed by JJN3 cells (10.8), U266 cells (10.41), OPM2 cells (9.03) and H929 cells (8.37). [1]

Primary CLL and normal lymphocytes were isolated by density gradient centrifugation using Histopaque (Sigma-Aldrich) and were then maintained in RPMI media containing 10% FBS, 5ng/ml IL-4, 1% L-glutamine and 1% penicillin and streptomycin. All cells were cultured at

37°C in 5% CO_2 atmospheric conditions. Cell counts and viability (trypan blue exclusion) were determined using the Vi-Cell XR cell counter (Beckman Coulter). Primary CLL cells were also co-cultured on CD40L-expressing fibroblasts (10:1 ratio) in order to mimic the lymph node microenvironment. Subsequently, synergy between ibrutinib and DC-1-192 was determined under these cytoprotective conditions.

Measurement of in vitro apoptosis

Aliquots of each cell type ($1x10^6$ cells) were cultured for 48h, harvested by centrifugation (300x*g* for 5 mins) and then resuspended in 195µL of a calcium-rich buffer. Subsequently, 5µL of Annexin V (Biolegend) was added to the cell suspension, and cells were incubated in the dark for 10 mins prior to washing. Cells were finally resuspended in 190µL of calcium-rich buffer together with 10µL of propidium iodide (PI). Apoptosis was assessed by dual-colour immunofluorescent flow cytometry using an Accuri C6 flow cytometer, and data were analysed using CFlow software (BD Biosciences).

Measurement of apoptosis in normal B- and T-lymphocytes

Peripheral blood mononuclear cells from age-matched healthy donors ($1x10^6$ cells) were treated with concentrations of DC-1-92, DC-1-170 and DC-1-192 between 1 nM-100nM for 48h. Cells were then harvested and stained with APC-conjugated CD19, PE-conjugated CD3 and FITC-conjugated Annexin V (Biolegend). Using an Accuri C6 flow cytometer, a gating strategy (shown in Figure 2) was employed to quantify apoptosis in $CD19^+$ B-cells and $CD3^+$ T-cells, with appropriate compensation applied.

Enzyme Linked Immuno-sorbent Assay (ELISA) for NF-κB subunits

JJN3 and U266 cells were treated for 4h with DC-1-92, DC-1-170 (0 nM-20nM) and DC-1-192 (0nM-5nM). Pellets containing $5x10^6$ cells were then harvested, and subsequently, nuclear extracts were prepared using a nuclear extraction kit (Active Motif). Total protein was determined by DC protein assay (Biorad) in each nuclear extract using a standard curve of known concentrations of BSA. Nuclear extracts containing 1 µg of total protein from each treatment were then added to an NF-κB family kit (Active Motif) in accordance with the manufacturer's instructions. Levels of p65, p50, p52 and Rel B DNA binding were then assessed to determine relative levels of each subunit in the nucleus. The absorbance measurements (450nm) were subsequently converted into ng/µg of nuclear extract for each sample.

Synergy with bortezomib and ibrutinib

The synergy between DC-1-192 in combination with either bortezomib or ibrutinib was determined in the JJN3 cells and primary CLL cells respectively. The molar ratios were experimentally determined using the mean LD_{50} value for DC-1-192 and the clinically achievable concentrations of bortezomib and ibrutinib. The fixed molar ratio for DC-1-192:bortezomib was 1:15 and was 1:3000 for DC-1-192:ibrutinib. Cells were treated with each drug individually and in combination at the defined molar ratio. Treated cells were incubated alongside untreated controls for 48h, before being labelled with Annexin V-FITC/PI and then analysed on an Accuri C6 flow cytometer. CalcuSyn software (Biosoft) was used to establish whether synergy was evident between the PBD compounds and bortezomib or ibrutinib and expressed as a combination index (CI); CI values <1 were considered to demonstrate synergy.

RNA Isolation

JJN3 cells were treated with either DC-1-170 or DC-1-192 at 20nM in triplicate alongside untreated controls for 4h. From each sample, $5x10^6$ cells were then harvested, washed in ice cold PBS and re-suspended in 1ml of Trizol reagent (Thermo Fisher). RNA was extracted following the addition of chloroform and 70% ethanol, and an RNeasy mini-kit (Qiagen) was then used in accordance with the manufacturer's instructions to isolate RNA to be used in RNA sequencing (RNA-seq) analysis.

RNA Sample Preparation and Sequencing

Total RNA quality and quantity was assessed using an Agilent 2100 Bioanalyzer and an RNA Nano 6000 kit (Agilent Technologies). 100-900 ng of Total RNA with an RNA integrity number (RIN) >8 was depleted of ribosomal RNA, and the sequencing libraries were prepared using the Illumina® TruSeq® Stranded Total RNA with Ribo-Zero Gold™ kit (Illumina Inc.). The steps included rRNA depletion and cleanup, RNA fragmentation, 1st strand cDNA synthesis, 2nd strand cDNA synthesis, adenylation of 3'-ends, adapter ligation, PCR amplification (12-cycles) and validation. The manufacturer's instructions were followed except for the cleanup after the Ribo-Zero depletion step where Ampure®XP beads (Beckman Coulter) and 80% Ethanol were used. The libraries were validated using the Agilent 2100 Bioanalyser and a high-sensitivity kit (Agilent Technologies) to ascertain the insert size, and the Qubit® (Life Technologies) was used to perform the fluorometric quantitation. Following validation, the libraries were normalized to 4nM, pooled together and clustered on the cBot™2 following the manufacturer's recommendations. The pool was then sequenced using a 75-base paired-end (2x75bp PE) dual index read format on the Illumina® HiSeq2500 in high-output mode according to the manufacturer's instructions. Subsequently, analysis was performed after

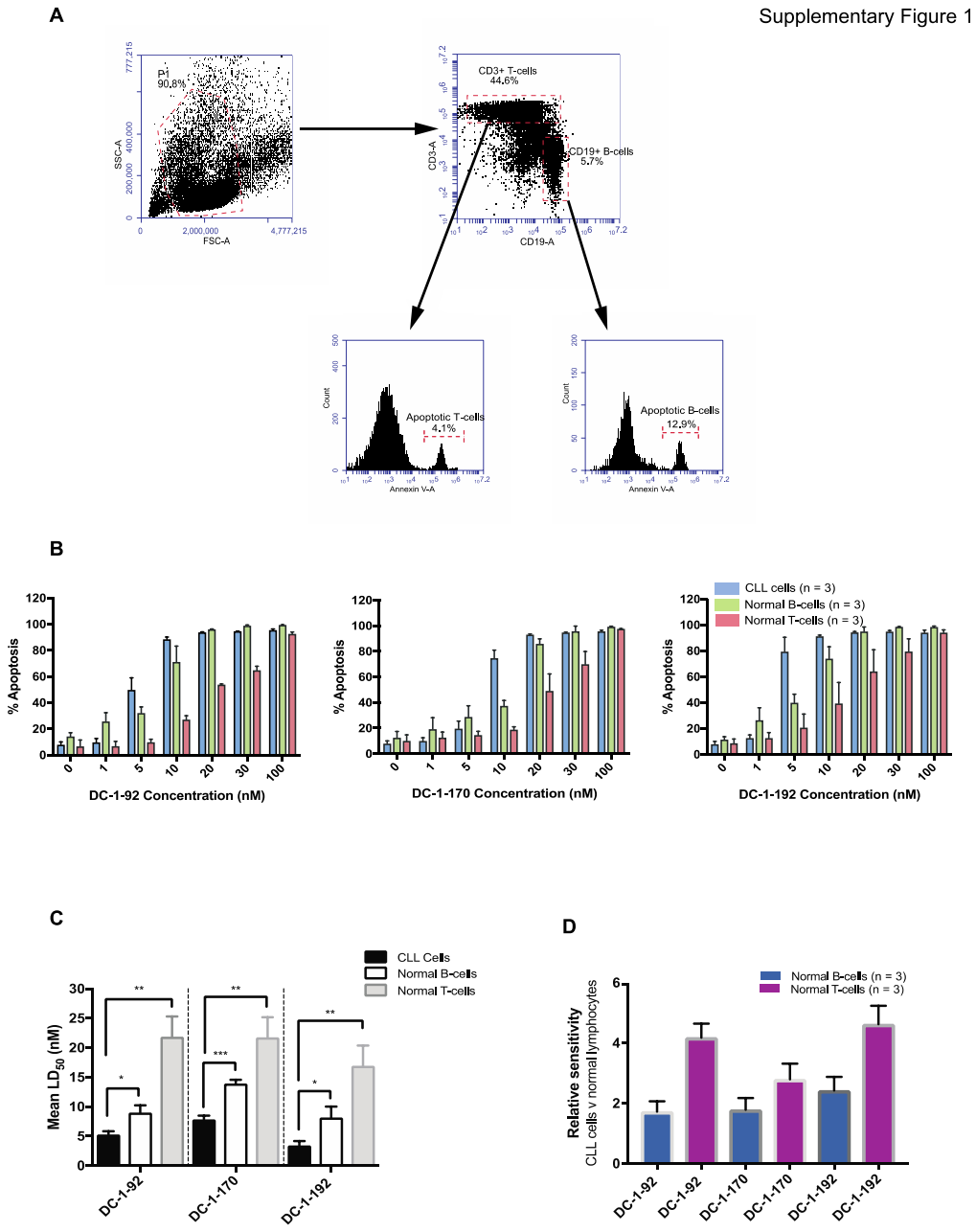
trimming to remove adaptor sequences and low-quality base calls. Trimmed reads were then mapped to the standard reference 'hg19' using the alignment software package 'bwa-mem' (http://bio-bwa.sourceforge.net). Downstream analysis of the data was performed using GenView2 software (in-house analysis tool developed by Peter Giles), Ingenuity Pathway Analysis (Qiagen) and WebGestalt (WEB-based GEne SeT AnaLysis Toolkit).

In vivo systemic xenograft model of myeloma in NOD/SCID mice

Female NOD/SCID mice were sourced from Beijing AK Bio-Technology Co. Ltd. (Beijing, China). The care and use of animals were conducted in accordance with the regulations of the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC). Before commencement of treatment, all animals' weights were measured. As body weight can influence the effectiveness of any given treatment, mice were assigned to groups using a randomized block design based on their body weight. Mice were sub-lethally irradiated with 200 cGy with a ^{60}Co source one day before inoculation with human myeloma cells. Subsequently, each mouse was inoculated intravenously into the tail vein with RPMI8226 tumor cells (1 x 10^7) in 0.1 mL of PBS to initiate tumor development. The date of tumor cell inoculation was denoted as Day 0; intravenous treatment with vehicle only; 0.05% DMSO in saline (n = 7) or 1mg/kg of DC-1-192 (n = 7) was started at Day 5 and continued once per day (five days/week) for three weeks. Survival was evaluated from the first day of treatment until death.

References

1. Demchenko YN, Glebov OK, Zingone A, Keats JJ, Bergsagel PL, Kuehl WM. Classical and/or alternative NF-kappaB pathway activation in multiple myeloma. Blood. 2010;115(17):3541-3552.



Supplementary Figure 1. PBDs showed preferential cytotoxicity in primary CLL cells compared with healthy non-malignant B- and T-lymphocytes. (A) Non-malignant B-cells and T-cells were identified using the gating strategy shown, which allowed the enumeration of the percentage of apoptotic cells in each lymphocyte subset. **(B)** Apoptotic dose-response graphs illustrating the comparative effects of DC-1-92, DC-1-170 and DC-1-192 on primary CLL cells and non-malignant B-cells and T-cells. **(C)** Comparison of the mean LD_{50} values showed that all three PBDs were significantly more potent in primary CLL cells when compared with age-matched normal B-cells and T-cells. **(D)** DC-1-192 showed the differential cytotoxic effects (therapeutic index), when comparing CLL cells with normal B-cells (2.4 fold) and CLL cells with normal T-cells (4.6 fold). P-values: *<0.05, **<0.01, ***<0.001 and ****<0.0001.

Supplementary Table 1. Summary of patient characteristics

Parameter	Number
Total number of CLL samples	46
IGHV-mutated	19
IGHV-unmutated	27
$CD38^-$(<20%)	21
$CD38^+$ (>20%)	25
B2M (<3.5mg/L)	26
B2M (>3.5mg/L)	17
ND	3
11q-	7
17p-	2
Trisomy 12	4
Normal or 13q-	33
NOTCH1 mutation	11
BIRC3 Mutation	3
ND	13

IGHV-mutated: >2% deviation from the germline immunoglobulin sequence
IGHV-unmutated: ≤2% deviation from the germline immunoglobulin sequence
B2M – beta 2 microglobulin
ND – not determined

Supplementary Table 2. Down regulated genes following treatment with DC-1-192 or DC-1-170.

NCBI gene	Symbol	p-value	fdr p-value	log2FC
NM_001178002	ATP8B3	0.000109833	0.000952962	-1.314857411
NM_138813	ATP8B3	0.000116051	0.001000195	-1.305261044
NM_053280	ODF3	0.000123633	0.001056964	-1.291597745
NM_173502	PRSS36	0.000134112	0.001135771	-1.283252911
NM_138277	C6orf25	0.000151094	0.001263734	-1.28048462
NR_033419	SLC39A2	0.000172884	0.001421191	-1.27659082
NM_014579	SLC39A2	0.000172884	0.001421191	-1.27659082
NM_001256588	SLC39A2	0.000172884	0.001421191	-1.27659082
NM_031948	PRSS27	0.000186671	0.001512764	-1.270186813
NM_002773	PRSS8	0.000188026	0.001521855	-1.27012031
NM_000835	GRIN2C	0.000205285	0.001636418	-1.252708627
NM_001198568	ADCY4	0.0002614	0.002014009	-1.242070041
NM_001198592	ADCY4	0.0002614	0.002014009	-1.242070041
NM_139247	ADCY4	0.0002614	0.002014009	-1.242070041
NM_001039771	CBLN3	0.000283877	0.002153685	-1.223676635
NM_015927	TGFB1I1	0.000185587	0.001506447	-1.222884725
NM_001906	CTRB1	0.00033854	0.002513216	-1.218446714
NM_032123	KIRREL2	0.000305352	0.002298301	-1.217407175

NM_199180	KIRREL2	0.000305352	0.002298301	-1.217407175
NM_152784	CATSPERD	0.000239338	0.001869228	-1.21132651
NM_016239	MYO15A	0.000154472	0.001288362	-1.211317261
NM_145239	PRRT2	0.0002754	0.00210225	-1.196779346
NM_024003	L1CAM	0.000454228	0.003232351	-1.192650599
NM_000425	L1CAM	0.000454228	0.003232351	-1.192650599
NM_001143963	L1CAM	0.000454228	0.003232351	-1.192650599
NM_199179	KIRREL2	0.000383961	0.00280004	-1.186031884
NM_018059	RADIL	0.000498364	0.003502809	-1.184281703
NM_001098671	RASGRP2	0.000527608	0.003675322	-1.178835719
NM_004183	BEST1	0.000382288	0.002791266	-1.176067984
NM_153606	FAM71A	0.000153225	0.001279041	-1.174446426
NM_001243212	LOC643669	0.000573822	0.003934532	-1.170096101
NM_173465	COL23A1	0.000512114	0.003583354	-1.16723966
NM_031309	SCRT1	0.00042775	0.003073865	-1.166277868
NM_138275	C6orf25	0.000455487	0.003238984	-1.165999221
NM_138274	C6orf25	0.000455487	0.003238984	-1.165999221
NM_138273	C6orf25	0.000455487	0.003238984	-1.165999221
NM_001256442	PRRT2	0.000389995	0.002838517	-1.164571775
NM_001139443	BEST1	0.000534296	0.003711469	-1.161578063
NM_000460	THPO	0.000633571	0.004284519	-1.154773442
NM_175931	CBFA2T3	0.000154789	0.001290286	-1.15435706
NM_001256508	TBC1D10C	0.000577404	0.003950887	-1.153010803
NM_152791	ZNF555	0.000132536	0.001123705	-1.152720641
NM_001172775	ZNF555	0.000132536	0.001123705	-1.152720641
NM_000064	C3	0.000291968	0.002208298	-1.152294082
NM_153819	RASGRP2	0.000740038	0.004841853	-1.147249819
NR_046266	TBC1D10C	0.000594811	0.004058785	-1.145683465
NM_005393	PLXNB3	0.000446766	0.003186881	-1.144637737
NM_001163257	PLXNB3	0.000446766	0.003186881	-1.144637737
NM_001177597	THPO	0.000730469	0.004795087	-1.141526079
NM_001177598	THPO	0.000730469	0.004795087	-1.141526079
NM_001506	GPR32	0.000633257	0.004283749	-1.140836784
NM_001007533	PPP1R27	0.00073842	0.004833396	-1.140808221
NM_001098670	RASGRP2	0.000845102	0.005400835	-1.135294123
NM_030792	GDPD5	0.000402889	0.002923726	-1.133162104
NM_001853	COL9A3	0.0001981	0.001589349	-1.13167239
NM_198517	TBC1D10C	0.000691803	0.004587881	-1.130426196
NM_138277	C6orf25	0.000841714	0.005380608	-1.129950694
NM_031308	EPPK1	0.00024828	0.001929935	-1.127144817
NM_000641	IL11	0.000707282	0.004669694	-1.123883233

NR_027254	LOC388387	0.00078255	0.005070874	-1.114064889
NM_014443	IL17B	0.000144645	0.001214239	-1.110541699
NR_027004	FAM181A-AS1	0.000733248	0.00480815	-1.105933979
NM_138272	C6orf25	0.001077966	0.006636403	-1.105862299
NM_025260	C6orf25	0.001077966	0.006636403	-1.105862299
NM_032512	PDZD4	0.000996112	0.006213574	-1.102384105
NM_153018	ZFP3	0.000935147	0.005892655	-1.101579931
NM_002870	RAB13	0.000523186	0.003649568	-1.101497332
NM_052874	STX1B	0.000830916	0.005327739	-1.100476726
NM_000150	FUT6	0.001181232	0.007157968	-1.099449761
NM_006149	LGALS4	0.001391485	0.008186647	-1.085832879
NR_002570	CYP2D7P1	0.000114372	0.000988025	-1.084491767
NM_001144826	RUNDC3A	0.000170832	0.001407436	-1.084313152
NM_006695	RUNDC3A	0.000167935	0.0013878	-1.084076727
NM_001247994	POU2F2	0.001289541	0.007693492	-1.076298778
NM_153345	TMEM139	0.000972023	0.006082462	-1.074796812
NM_001242773	TMEM139	0.000972023	0.006082462	-1.074796812
NM_001242775	TMEM139	0.000972023	0.006082462	-1.074796812
NM_002698	POU2F2	0.001336718	0.007924045	-1.073014597
NM_001207025	POU2F2	0.001336718	0.007924045	-1.073014597
NM_006071	PKDREJ	0.001623767	0.009302771	-1.071052625
NM_033165	FGF8	0.000266837	0.002047405	-1.062894788
NM_006119	FGF8	0.000266837	0.002047405	-1.062894788
NM_138277	C6orf25	0.001372742	0.008092395	-1.062874997
NM_138272	C6orf25	0.001372742	0.008092395	-1.062874997
NM_138273	C6orf25	0.001372742	0.008092395	-1.062874997
NM_025260	C6orf25	0.001372742	0.008092395	-1.062874997
NM_001242376	GFAP	0.001287378	0.007683626	-1.062788372
NM_001080487	PABPN1L	0.001765233	0.009976689	-1.062108899
NM_022124	CDH23	0.001219453	0.007349552	-1.061403733
NM_001122890	GGT6	0.000664366	0.004445832	-1.059758779
NM_001135217	LRRC23	0.000101228	0.00088711	-1.058471034
NM_198993	STAC2	0.000243504	0.001898269	-1.056535015
NM_198478	NKPD1	0.000278178	0.002118013	-1.056453622
NM_001143980	CCDC154	0.001283842	0.007670273	-1.055886169
NR_040090	CYP21A1P	0.001334671	0.00791507	-1.053674168
NM_001037340	PDE4B	0.000106826	0.000930133	-1.049661921
NM_021924	CDHR5	0.000240185	0.001874366	-1.049425969
NM_001171968	CDHR5	0.000240185	0.001874366	-1.049425969
NR_040003	TMEM139	0.001312632	0.007806178	-1.044378348
NM_001242776	TMEM139	0.001312632	0.007806178	-1.044378348

NM_001242777	TMEM139	0.001312632	0.007806178	-1.044378348
NM_153254	TTLL10	0.000387329	0.002821835	-1.043862629
NM_001130413	SCNN1D	0.001850883	0.010373953	-1.043125628
NM_152612	CCDC116	0.001907355	0.010614393	-1.043060394
NM_001077191	GPBAR1	0.00032725	0.002440983	-1.04018659
NM_006142	SFN	0.002226097	0.012049714	-1.040074778
NM_138275	C6orf25	0.002052989	0.011285364	-1.039853301
NM_138274	C6orf25	0.002052989	0.011285364	-1.039853301
NM_138273	C6orf25	0.002052989	0.011285364	-1.039853301
NM_001004342	TRIM67	0.00212087	0.011602708	-1.038914334
NM_001040701	FUT6	0.002141599	0.011681698	-1.038061965
NM_021819	LMAN1L	0.001316725	0.00782739	-1.035025423
NM_001018116	MURC	0.001590258	0.009145161	-1.033731276
NM_001105669	TTC24	0.00038197	0.002790691	-1.031649465
NM_138275	C6orf25	0.001860244	0.010404834	-1.030787156
NM_138274	C6orf25	0.001860244	0.010404834	-1.030787156
NM_001130045	TTLL10	0.000856553	0.005464616	-1.029950483
NM_001408	CELSR2	0.00031597	0.002365162	-1.025670909
NM_001051	SSTR3	0.002383825	0.012725011	-1.024838163
NM_001161440	PTPRH	0.00259671	0.013631239	-1.024311633
NM_006841	SLC38A3	0.0014923	0.00866146	-1.022174013
NM_153338	GGT6	0.00095876	0.006017203	-1.02181118
NM_001077194	GPBAR1	0.001080955	0.006650669	-1.019459029
NM_176820	NLRP9	0.002641647	0.013815878	-1.019252561
NM_005975	PTK6	0.002662642	0.013908731	-1.01871768
NM_001100876	PHYHD1	0.002837349	0.014630834	-1.014863597
NM_024637	GAL3ST4	0.002705608	0.014088411	-1.013656315
NR_037668	SCNN1D	0.002571701	0.013529165	-1.013185545
NM_152536	FGD5	0.002764637	0.014327996	-1.013175585
NM_001100877	PHYHD1	0.002869676	0.014766779	-1.011343557
NM_174933	PHYHD1	0.002961466	0.015105713	-1.008953463
NM_052819	CARD14	0.001287629	0.007683626	-1.008282523
NM_014428	TJP3	0.002946509	0.015068219	-1.007851462
NM_201650	LRRC23	0.000262011	0.002017671	-1.006671443
NM_182704	SELV	0.00115256	0.007020011	-1.005582114
NM_207348	SLC25A34	0.000360877	0.002652532	-1.001194349
NM_002292	LAMB2	0.00189131	0.010542871	-1.000978473
NM_001042454	TGFB1I1	0.002341286	0.012553553	-1.00042358
NM_001164719	TGFB1I1	0.002341286	0.012553553	-1.00042358
NM_138296	PTCRA	0.000413202	0.002986892	-0.999781656
NM_001039616	SPRED3	0.003413171	0.016958571	-0.996005599

NM_005309	GPT	0.000260111	0.002006674	-0.995256094
NM_004062	CDH16	0.002955481	0.015101105	-0.990353698
NM_006992	LRRC23	0.000431963	0.003097647	-0.988680871
NM_145044	ZNF501	0.000474171	0.003350996	-0.987824617
NM_005187	CBFA2T3	0.002834804	0.01462025	-0.984513578
NM_024895	PDZD7	0.003351408	0.016699159	-0.984068893
NM_001080395	AATK	0.003568841	0.017573363	-0.983912128
NM_033164	FGF8	0.000977972	0.006114534	-0.983191999
NM_033163	FGF8	0.000977972	0.006114534	-0.983191999
NM_001008409	TTLL9	0.001815318	0.010203481	-0.982160005
NM_000500	CYP21A2	0.002697415	0.014055601	-0.978149928
NM_001039651	SAPCD1	0.003764744	0.018329028	-0.976417846
NM_001098199	GPR1	0.00117849	0.007145724	-0.976390326
NM_005279	GPR1	0.00117849	0.007145724	-0.976390326
NM_001142685	ARHGAP32	0.000374211	0.002740371	-0.97559284
NM_001982	ERBB3	0.003872373	0.018732755	-0.975243887
NM_001166035	SBSN	0.002302045	0.01239534	-0.97441548
NR_001284	TNXA	0.001070827	0.006596552	-0.972882525
NM_032470	TNXB	0.001070827	0.006596552	-0.972882525
NM_000515	GH1	0.001815179	0.010203481	-0.967749221
NM_022559	GH1	0.001815179	0.010203481	-0.967749221
NR_027447	LOC100289341	0.000189557	0.001530306	-0.967436391
NM_001256358	PTK6	0.004426525	0.020873222	-0.966281599
NM_001203264	IL17RC	0.000364711	0.00267872	-0.963640024
NM_019858	GPR162	0.003321422	0.016571977	-0.963547274
NM_001135219	PIP5KL1	0.000195375	0.0015696	-0.962759159
NM_001204285	MUC1	0.004473907	0.021036567	-0.962077937
NM_001204286	MUC1	0.004473907	0.021036567	-0.962077937
NM_001012974	LRRC73	0.004715676	0.021957967	-0.960852093
NM_001204744	CDH16	0.00386224	0.018695909	-0.960563236
NM_001204745	CDH16	0.00386224	0.018695909	-0.960563236
NM_022560	GH1	0.001669034	0.009519899	-0.959436086
NR_003608	MGC16703	0.003984202	0.019149044	-0.959055364
NM_005468	NAALADL1	0.004689035	0.021864751	-0.958974115
NM_198538	SBSN	0.003102501	0.015685098	-0.958086639
NM_001171933	CDH23	0.003315246	0.016543938	-0.957617604
NM_001013638	PRR25	0.004964923	0.022896124	-0.955400426
NM_001203265	IL17RC	0.000337522	0.002507865	-0.955393178
NM_001131019	GFAP	0.003494719	0.017282836	-0.954020464
NM_031310	PLVAP	0.000700261	0.004634088	-0.953716597
NM_024059	C20orf195	0.002912201	0.014925384	-0.951880318

NM_001256541	TMEM204	0.004693659	0.021882878	-0.950137279
NM_001114726	PRRT4	0.002901832	0.014888278	-0.948945708
NM_002910	RENBP	0.003823967	0.018540845	-0.948173356
NR_003246	GOLGA6L5	0.005190279	0.023689067	-0.947561745
NR_026711	ASMTL-AS1	0.001545884	0.008932344	-0.944719294
NM_004646	NPHS1	0.000363265	0.00266942	-0.943521757
NM_001174164	PRRT4	0.003759089	0.018309465	-0.942846189
NM_001243332	SEZ6L2	0.000560139	0.003857624	-0.942631586
NM_138277	C6orf25	0.003781272	0.018384026	-0.941326026
NM_138272	C6orf25	0.003781272	0.018384026	-0.941326026
NM_025260	C6orf25	0.003781272	0.018384026	-0.941326026
NM_001171743	C3orf18	0.005692084	0.025466979	-0.940625891
NM_080834	C20orf152	0.002322995	0.01246298	-0.939979319
NM_020686	ABAT	0.002680114	0.013982608	-0.939481273
NM_000663	ABAT	0.002680114	0.013982608	-0.939481273
NM_001127448	ABAT	0.002680114	0.013982608	-0.939481273
NM_001080400	PLIN4	0.00312887	0.015788864	-0.939280615
NM_201575	SEZ6L2	0.000627839	0.004253548	-0.938259201
NM_002842	PTPRH	0.005685107	0.025447256	-0.93737017
NM_001164271	DLC1	0.001952312	0.010828081	-0.935003219
NM_006094	DLC1	0.001952312	0.010828081	-0.935003219
NM_018841	GNG12	0.002191803	0.011903109	-0.934771216
NM_182643	DLC1	0.001959105	0.010861704	-0.934608828
NM_001104629	C4orf19	0.001374967	0.008103908	-0.934538397
NM_144650	ADHFE1	0.005884094	0.026102046	-0.934529561
NM_001204746	CDH16	0.004269133	0.020275822	-0.93438187
NM_004920	AATK	0.005784522	0.025769858	-0.934242835
NM_014370	SRPK3	0.002748649	0.01426741	-0.9340783
NM_001170760	SRPK3	0.002748649	0.01426741	-0.9340783
NM_001170761	SRPK3	0.002748649	0.01426741	-0.9340783
NM_001710	CFB_dup1	0.003083132	0.015600449	-0.932066533
NM_003243	TGFBR3	0.001967059	0.010895639	-0.931143673
NM_001195683	TGFBR3	0.001967059	0.010895639	-0.931143673
NR_036634	TGFBR3	0.001967059	0.010895639	-0.931143673
NM_012410	SEZ6L2	0.000668996	0.004469546	-0.930757496
NM_138809	CMBL	0.002305063	0.012404848	-0.930687223
NR_046200	LOC400558	0.001631242	0.009337147	-0.930001886
NR_037807	IL17RC	0.000396974	0.002885025	-0.928470134
NM_001171934	CDH23	0.004221572	0.020091682	-0.926578271
NM_001114099	SEZ6L2	0.000751548	0.004899903	-0.926133643
NM_001037339	PDE4B	0.003435257	0.017035649	-0.92586623

NM_001166034	SBSN	0.006462333	0.028212304	-0.925594205
NM_001195684	TGFBR3	0.002320893	0.012460702	-0.925106038
NR_002930	PTPRVP	0.004224546	0.020099395	-0.924941658
NM_021569	GRIN1	0.00099666	0.006215688	-0.921264203
NM_003049	SLC10A1	0.000668709	0.004468635	-0.919251556
NR_002773	AOC4	0.005016338	0.023055814	-0.918423311
NM_033025	SYDE1	0.005605074	0.025161027	-0.918395566
NM_031264	CDHR5	0.00189458	0.01055714	-0.918375549
NM_001203263	IL17RC	0.000617937	0.00420019	-0.918089274
NM_003738	PTCH2	0.000786021	0.005087824	-0.918025904
NM_032214	SLA2	0.000133744	0.001132971	-0.916888306
NM_001042522	SPRED3	0.00586107	0.026030997	-0.91677008
NM_001243333	SEZ6L2	0.000875368	0.00556358	-0.915853124
NM_007327	GRIN1	0.001049047	0.006489283	-0.911935831
NM_153460	IL17RC	0.000565434	0.003886882	-0.911117999
NM_032732	IL17RC	0.000565434	0.003886882	-0.911117999
NR_026864	PRSS30P	0.001846562	0.010353639	-0.90693085
NR_002946	MMP23A	0.006407748	0.028031658	-0.905744367
NM_003709	KLF7	0.007413631	0.031554119	-0.90498505
NM_153461	IL17RC	0.000535585	0.003719559	-0.904797639
NM_002501	NFIX	0.00115363	0.007025085	-0.904244331
NM_033310	KCNK4	0.002070984	0.011369561	-0.903498835
NM_000283	PDE6B	0.007754327	0.032690502	-0.903132337
NM_001145291	PDE6B	0.007754327	0.032690502	-0.903132337
NM_001145292	PDE6B	0.007754327	0.032690502	-0.903132337
NM_015237	KIAA1107	0.004926227	0.022745911	-0.902129408
NM_015693	INTU	0.002047468	0.011271692	-0.899488614
NM_018302	C4orf19	0.00227603	0.012275277	-0.89860835
NM_153007	ODF4	0.001531493	0.008864701	-0.897872789
NM_005985	SNAI1	0.000575793	0.003943496	-0.897535009
NM_175077	SLA2	0.000200285	0.001604281	-0.897282221
NM_018674	ACCN4	0.007005998	0.030195395	-0.896379141
NM_182847	ACCN4	0.007005998	0.030195395	-0.896379141
NM_001105539	ZBTB10	0.000119528	0.001025998	-0.895601665
NM_138278	BNIPL	0.000161049	0.001337585	-0.894738461
NM_000506	F2	0.004883909	0.022592639	-0.894328983
NM_182920	ADAMTS9	0.000753208	0.004907497	-0.892686553
NM_001195014	CD4	0.001218496	0.007346327	-0.891444023
NM_001195017	CD4	0.001218496	0.007346327	-0.891444023
NM_001195016	CD4	0.001218496	0.007346327	-0.891444023
NM_001195015	CD4	0.001218496	0.007346327	-0.891444023

NM_000616	CD4	0.001218496	0.007346327	-0.891444023
NM_001171740	C3orf18	0.008840918	0.036208045	-0.890371558
NM_032546	TRIM54	0.007102826	0.030545452	-0.889656284
NM_016210	C3orf18	0.008893403	0.036342855	-0.889588264
NM_001114100	SEZ6L2	0.001909155	0.010622421	-0.887754319
NM_000633	BCL2	0.002605988	0.013665457	-0.887109543
NM_032281	ELAVL3	0.002605988	0.013665457	-0.887109543
NM_198479	TPRX1	0.001397454	0.00821526	-0.886725014
NM_198476	C19orf54	0.001718057	0.009756847	-0.885357931
NM_014722	FAM65B	0.009274153	0.037487855	-0.88493044
NM_144698	ANKRD35	0.009316253	0.037625863	-0.884918872
NM_001128827	DLG4	0.004550814	0.021330684	-0.884165765
NM_032649	CNDP1	0.009248071	0.037396236	-0.881167677
NM_014726	TBKBP1	0.000686151	0.004557519	-0.880596272
NM_001166292	PTCH2	0.000580661	0.003971346	-0.880250986
NM_138277	C6orf25	0.00371441	0.018160765	-0.879794814
NM_058164	OLFM2	0.009735321	0.038974071	-0.879419576
NM_024719	GRTP1	0.009878486	0.039430352	-0.878071819
NR_033910	LOC100130275	0.009876657	0.039428348	-0.878014708
NM_080877	SLC34A3	0.009896746	0.039471426	-0.877892666
NM_001207026	POU2F2	0.003894169	0.018810635	-0.877873405
NM_014715	ARHGAP32	0.00310372	0.015685695	-0.876488234
NM_170699	GPBAR1	0.006324065	0.02774317	-0.87354721
NM_005980	S100P	0.007112582	0.030569004	-0.873348832
NR_033875	FLJ12334	0.010377101	0.041029311	-0.872234076
NM_001163724	LOC388588	0.008234575	0.034224738	-0.871638936
NM_001024215	FBLIM1	0.009064054	0.036852714	-0.871187013
NM_187841	TRIM54	0.008476631	0.035020165	-0.870772489
NM_207627	ABCG1	0.005109285	0.023387649	-0.870621761
NM_207628	ABCG1	0.005109285	0.023387649	-0.870621761
NM_207629	ABCG1	0.005109285	0.023387649	-0.870621761
NM_005373	MPL	0.0098527	0.039353854	-0.870512368
NM_016818	ABCG1	0.005094093	0.023336082	-0.870423543
NM_004915	ABCG1	0.005094093	0.023336082	-0.870423543
NM_207174	ABCG1	0.005094093	0.023336082	-0.870423543
NM_001099439	EPHA10	0.00945346	0.038060762	-0.869757285
NM_022367	SEMA4A	0.000478412	0.003374546	-0.86882875
NM_001193300	SEMA4A	0.000478412	0.003374546	-0.86882875
NM_003782	B3GALT4	0.003379487	0.016808068	-0.867301756
NM_001004323	C7orf61	0.009848749	0.039348653	-0.867182287
NR_028048	CRAT	0.002739253	0.014236164	-0.866505914

NM_001243168	PTCRA	0.003229311	0.016191235	-0.866004161
NM_031936	GPR61	0.007771078	0.032747182	-0.865545847
NM_206961	LTK	0.009079092	0.036898712	-0.865269304
NM_002344	LTK	0.009079092	0.036898712	-0.865269304
NM_001525	HCRTR1	0.010370774	0.04101521	-0.864734017
NM_138275	C6orf25	0.007275793	0.031114511	-0.864712138
NM_138274	C6orf25	0.007275793	0.031114511	-0.864712138
NM_000600	IL6	0.007275793	0.031114511	-0.864712138
NM_020804	PACSIN1	0.002274023	0.012270993	-0.861679331
NM_001199583	PACSIN1	0.002274023	0.012270993	-0.861679331
NM_001185091	GRIN1	0.002582327	0.013567718	-0.853254789
NM_000832	GRIN1	0.002582327	0.013567718	-0.853254789
NM_001177317	SLC34A3	0.012237383	0.046814921	-0.852639442
NM_001177316	SLC34A3	0.012237383	0.046814921	-0.852639442
NM_001159554	P2RX6	0.0010966	0.006734381	-0.852236548
NM_005446	P2RX6	0.0010966	0.006734381	-0.852236548
NM_001139515	DACH2	0.009881523	0.039437175	-0.851706277
NM_014276	RBPJL	0.004123631	0.019698112	-0.850028003
NM_001243169	PTCRA	0.001545323	0.008931224	-0.849589511
NM_001193301	SEMA4A	0.00068495	0.004552597	-0.849526846
NM_006314	CNKSR1	0.009143946	0.037111533	-0.849496088
NR_023345	CNKSR1	0.009143946	0.037111533	-0.849496088
NM_178545	TMEM52	0.009757996	0.039054324	-0.848588846
NM_152654	DAND5	0.007650798	0.032359819	-0.847025155
NM_001159642	BNIPL	0.000275258	0.002101707	-0.846635501
NM_001710	CFB	0.012101138	0.046395241	-0.846239852
NM_172168	NOXO1	0.000665884	0.004452761	-0.846091745
NM_001185090	GRIN1	0.002701235	0.014070859	-0.844676042
NM_000359	TGM1	0.00731877	0.03126231	-0.844617377
NM_000755	CRAT	0.003795678	0.018427733	-0.844597342
NM_005608	PTPRCAP	0.010619239	0.041758889	-0.84434005
NM_017857	SSH3	0.001046233	0.006478621	-0.841905474
NR_038988	LOC100287765	0.00499089	0.02298021	-0.841193859
NM_001195520	LOC100507055	0.011403858	0.044299145	-0.837017585
NM_001242774	TMEM139	0.011610621	0.04492232	-0.836829726
NM_199242	UNC13D	0.010837574	0.042443357	-0.836445361
NM_053006	TSSK2	0.005999274	0.026529826	-0.836109259
NM_001144825	RUNDC3A	0.00209286	0.011474817	-0.834457544
NM_002386	MC1R	0.000181882	0.001480008	-0.833578026
NM_025260	C6orf25	0.005616122	0.025188789	-0.831308601
NM_000576	IL1B	0.005616122	0.025188789	-0.831308601

NR_027262	C15orf34	0.009471408	0.03811267	-0.831125519
NM_001083606	PTCH1	0.003487124	0.017253889	-0.830829503
NM_006950	SYN1	0.009161102	0.037150719	-0.830156924
NM_133499	SYN1	0.009161102	0.037150719	-0.830156924
NM_000264	PTCH1	0.003806388	0.01847068	-0.830036907
NM_001001891	ANO7	0.004995031	0.022992152	-0.829017276
NM_005167	PPM1J	0.009199957	0.037268872	-0.828578339
NM_139021	MAPK15	0.004461323	0.020990681	-0.827436818
NM_052948	ARHGAP33	0.003767336	0.018338073	-0.82489207
NM_001199989	RASD1	0.000721132	0.004747881	-0.82384304
NM_001205319	NXN	0.005214281	0.023766806	-0.821873104
NM_024042	METRN	0.000659226	0.004420178	-0.81877216
NR_037642	LOC100527964	0.005508449	0.024813489	-0.817873038
NM_001037125	UNKL	0.001474808	0.00857333	-0.816978038
NM_001193302	SEMA4A	0.001649097	0.009424272	-0.816444134
NM_001014980	FAM132A	0.005346643	0.024246327	-0.815637429
NM_002034	FUT5	0.006914079	0.029877225	-0.815085637
NM_001099434	DCDC2B	0.008483008	0.035041637	-0.815066797
NM_000748	CHRNB2	0.000323889	0.002417127	-0.813285519
NM_023072	ZSWIM4	0.002195471	0.011916493	-0.813060438
NM_152527	SLC16A14	0.000203255	0.001624567	-0.812099199
NR_026710	ASMTL-AS1	0.005799368	0.02581222	-0.811525899
NM_172167	NOXO1	0.001208465	0.007304324	-0.811462321
NR_037718	EFEMP2	0.005100172	0.023360327	-0.811105678
NM_020910	KIAA1549	0.00041058	0.002972282	-0.810724234
NM_030765	B3GNT4	0.000109831	0.000952962	-0.81040059
NM_001164665	KIAA1549	0.000421659	0.003037682	-0.810205208
NM_173582	PGM2L1	0.000357331	0.002631021	-0.809714217
NR_033361	TMCC1	0.000205292	0.001636418	-0.808651483
NM_001083603	PTCH1	0.00501662	0.023055814	-0.807816004
NM_001083602	PTCH1	0.00501662	0.023055814	-0.807816004
NM_013974	DDAH2	0.000300522	0.002268959	-0.807362647
NM_001080465	C17orf98	0.002313854	0.012434144	-0.804539166
NM_016084	RASD1	0.000796676	0.005144464	-0.803834107
NM_001144060	NHSL1	0.000125216	0.001068165	-0.799818466
NM_207380	C15orf52	0.012544693	0.047689732	-0.79812324
NM_001243195	INPP5F	0.005398462	0.02443755	-0.797452381
NR_038449	LOC440288	0.000437516	0.003132024	-0.797183009
NM_032370	ZNF414	0.00835161	0.034620733	-0.794725825
NM_001207076	C20orf152	0.008022777	0.03356037	-0.793415772
NM_138275	C6orf25	0.00778122	0.032762043	-0.792954572

NM_138273	C6orf25	0.00778122	0.032762043	-0.792954572
NM_138274	C6orf25	0.00778122	0.032762043	-0.792954572
NM_006181	NTN3	0.007437195	0.031604622	-0.792362325
NM_014246	CELSR1	0.000229119	0.001797923	-0.790606201
NM_001164730	REEP1	0.012497385	0.047546381	-0.789651561
NM_053281	DACH2	0.009548002	0.038348154	-0.788522976
NM_053284	WFIKKN1	0.007133018	0.030618501	-0.787719623
NM_032580	HES7	0.007213848	0.030907154	-0.786807627
NM_001165967	HES7	0.007213848	0.030907154	-0.786807627
NM_016938	EFEMP2	0.006715838	0.029147736	-0.784302885
NM_001163213	FGFR3	0.000530996	0.00369459	-0.783040493
NM_033064	ATCAY	0.004941398	0.022812417	-0.779013024
NM_002250	KCNN4	0.004844033	0.022441182	-0.777193954
NM_000142	FGFR3	0.000672329	0.00448778	-0.775882306
NM_015311	OBSL1	0.00617628	0.027187157	-0.772208417
NM_001114171	FOSB	0.0006273	0.004252162	-0.771672497
NM_172166	MSH5	0.00179555	0.010113412	-0.770546371
NM_172165	MSH5	0.00179555	0.010113412	-0.770546371
NM_002441	MSH5	0.00179555	0.010113412	-0.770546371
NR_038448	LOC440288	0.000555742	0.003830894	-0.770391611
NM_001083605	PTCH1	0.007222075	0.030929301	-0.77019033
NM_001146175	ZNF414	0.009508995	0.038233205	-0.768551618
NM_001083607	PTCH1	0.007516057	0.03189414	-0.767915813
NR_026914	MGC16275	0.002033424	0.011202679	-0.766686847
NM_022463	NXN	0.008981935	0.036629086	-0.765437845
NM_006732	FOSB	0.000522794	0.003647777	-0.762049012
NM_021641	ADAM12	0.000266221	0.002044264	-0.760872636
NM_001013653	LRRC26	0.000947726	0.005960547	-0.760617186
NM_138690	GRIN3B	0.000116317	0.001002198	-0.760158025
NM_001012302	ANO9	0.002220903	0.012032383	-0.759580364
NM_000409	GUCA1A	0.00807257	0.033711714	-0.759258671
NM_014975	MAST1	0.011714022	0.045214734	-0.756405907
NM_001083604	PTCH1	0.008332486	0.034562975	-0.755137781
NM_174942	GAS2L3	0.009713942	0.038898962	-0.754160716
NR_036532	UBAC2-AS1	0.007840598	0.032962618	-0.753359159
NM_020870	SH3RF1	0.002113062	0.011566376	-0.753342112
NM_013278	IL17C	0.009611448	0.038571694	-0.753071308
NR_037846	MSH5-SAPCD1	0.000685569	0.004554676	-0.752078428
NM_005418	ST5	0.003163075	0.015918223	-0.749484657
NM_213618	ST5	0.003163075	0.015918223	-0.749484657
NM_014298	QPRT	0.000906743	0.005730688	-0.747850847

NM_013974	DDAH2	0.001134306	0.006930132	-0.746680315
NM_030773	TUBB1	0.0043947	0.020756088	-0.745252736
NM_003052	SLC34A1	0.002138	0.011674923	-0.743937321
NM_007000	UPK1A	0.003583452	0.017630703	-0.742614419
NR_024120	DBIL5P	0.006560579	0.028574047	-0.742573111
NM_001003794	MGLL	0.009052305	0.036839321	-0.742400897
NM_025259	MSH5	0.001443171	0.008430652	-0.741807518
NM_022965	FGFR3	0.001366349	0.008067514	-0.740512698
NM_001136503	C19orf77	0.005262963	0.023958251	-0.73896229
NM_003159	CDKL5	0.007414702	0.031554159	-0.738459836
NM_172166	MSH5	0.001171672	0.007113087	-0.737672128
NM_172165	MSH5	0.001171672	0.007113087	-0.737672128
NM_000901	NR3C2	0.002550001	0.013443032	-0.737362926
NM_031945	TSPAN10	0.002274242	0.012270993	-0.736377694
NM_020464	NHSL1	0.000545233	0.00377509	-0.734223272
NR_026951	LINC00324	0.000719714	0.004740193	-0.733045221
NM_018440	PAG1	0.001111286	0.006809087	-0.728417077
NR_002186	DKFZP586I1420	0.000537885	0.003732191	-0.727765618
NM_032805	ZSCAN10	0.007868433	0.033044972	-0.727512676
NR_037932	APOC4-APOC2	0.007835309	0.032952429	-0.72650462
NM_001037343	CDKL5	0.008633337	0.035524352	-0.725398626
NR_037421	MIR3648	0.003722759	0.018192606	-0.724241955
NM_002441	MSH5_dup4	0.001312032	0.007806178	-0.722993901
NM_001105	ACVR1	0.004774314	0.022189287	-0.722369803
NM_139157	ST5	0.00484045	0.022437008	-0.720683145
NM_003392	WNT5A	0.002602414	0.013656352	-0.718194071
NR_038910	LOC100129845	0.008388171	0.034735464	-0.717589745
NM_181714	LCA5	0.005925263	0.02627291	-0.712457672
NM_005232	EPHA1	0.00797593	0.033406726	-0.709197902
NM_025259	MSH5	0.004456277	0.020974757	-0.708652868
NM_024866	ADM2	0.008589019	0.035387157	-0.708623397
NM_004742	MAGI1	0.000837005	0.005356965	-0.706039018
NM_001130025	FAM115C	0.00051567	0.003605683	-0.704960943
NM_152783	D2HGDH	0.000180312	0.001470244	-0.704077025
NM_003596	TPST1	0.004299726	0.020391789	-0.704006444
NM_001111067	ACVR1	0.006451156	0.028171787	-0.700983175
NM_020064	BARHL1	0.010610746	0.041736537	-0.700687135
NM_001166104	NR3C2	0.004745659	0.022083739	-0.699653623
NM_173492	PIP5KL1	0.012470189	0.04748307	-0.698358923
NM_001080491	USP6NL	0.000338296	0.002512032	-0.696601502
NR_037458	MIR3687	0.003647146	0.017885518	-0.69639158

NM_005567	LGALS3BP	0.001517372	0.008793241	-0.693730102
NM_003565	ULK1	0.000732482	0.004805995	-0.693538394
NM_020404	CD248	0.003270422	0.016366982	-0.692984825
NM_001256313	STK3	0.000127942	0.00108879	-0.692308685
NM_001122769	LCA5	0.00795801	0.033341067	-0.691084648
NM_005456	MAPK8IP1	0.001050303	0.006493002	-0.688240339
NM_001253845	ADM2	0.011935464	0.045890307	-0.687757625
NM_178564	NRBP2	0.006732472	0.0292114	-0.687379558
NM_002334	LRP4	0.00158984	0.009145161	-0.684851332
NM_025008	ADAMTSL4	0.001625708	0.009312098	-0.684644442
NM_003749	IRS2	0.006314457	0.027709201	-0.683108522
NM_001146316	SPSB2	0.000440024	0.003147096	-0.681696958
NM_001082968	TOM1L2	0.000315047	0.002359439	-0.681539002
NR_034086	LOC648987	0.000108081	0.000939684	-0.680196631
NM_001202233	NR4A1	0.000132301	0.001122351	-0.677440194
NM_025257	SLC44A4	0.008796108	0.036064287	-0.677416205
NM_153618	SEMA6D	0.001902728	0.010598572	-0.676881772
NM_001162499	CAND2	0.003911425	0.01887558	-0.676429313
NM_006213	PHKG1	0.000897434	0.005682726	-0.676128468
NM_152795	HIF3A	0.009237867	0.037362298	-0.675013343
NM_022462	HIF3A	0.009237867	0.037362298	-0.675013343
NM_152794	HIF3A	0.009237867	0.037362298	-0.675013343
NM_001135191	ASAP2	0.001873551	0.010469406	-0.674594166
NM_133465	KIAA1958	0.000299335	0.002260566	-0.67091041
NM_144603	NOXO1	0.002691835	0.014033906	-0.6691673
NM_001256105	WNT5A	0.006953562	0.030030373	-0.668919765
NM_013264	DDX25	0.01057461	0.041633033	-0.668296022
NR_024089	LINC00162	0.004011272	0.019251126	-0.668131287
NM_001136021	NFATC2	0.006989638	0.030150797	-0.667209393
NM_173091	NFATC2	0.007128076	0.030614644	-0.666993523
NM_002441	MSH5	0.000531399	0.003695972	-0.666521851
NM_020928	ZSWIM6	0.005268433	0.023964988	-0.666140803
NM_001145524	YPEL3	0.000173096	0.001422536	-0.665778035
NM_001001666	ANO7	0.004102128	0.019620623	-0.66537749
NM_003887	ASAP2	0.002096436	0.011488068	-0.665061864
NM_019032	ADAMTSL4	0.000278551	0.002119225	-0.664434207
NM_153619	SEMA6D	0.002280698	0.012295989	-0.662063195
NM_032219	MFSD7	0.006430953	0.028106948	-0.662045026
NM_001171093	FAM131A	0.00012867	0.001094046	-0.661590781
NM_153617	SEMA6D	0.002381137	0.012713986	-0.660450335
NM_032641	SPSB2	0.000643766	0.004341989	-0.660323301

NM_012340	NFATC2	0.007912325	0.033182413	-0.658855196
NM_178176	MOGAT3	0.004341274	0.020556027	-0.658421393
NM_152386	SGPP2	0.001394089	0.008198721	-0.658390082
NM_001184797	TMLHE	0.00372591	0.018202017	-0.657213198
NM_172166	MSH5	0.000721361	0.004747881	-0.656346287
NM_172165	MSH5	0.000721361	0.004747881	-0.656346287
NM_033219	TRIM14	0.001833389	0.010289486	-0.655118315
NM_012298	CAND2	0.005519366	0.02485513	-0.653943109
NM_198537	YJEFN3	0.005295458	0.024046008	-0.653493863
NM_020858	SEMA6D	0.002623436	0.013742404	-0.652941074
NM_153616	SEMA6D	0.002636522	0.013796359	-0.652870558
NM_001256733	SSBP2	0.000584814	0.00399699	-0.652222373
NM_024506	GLB1L	0.004592404	0.021468061	-0.652005262
NM_032387	WNK4	0.009318467	0.03762969	-0.651754076
NM_001242935	SNCAIP	0.007361533	0.031391755	-0.648621168
NM_001033551	TOM1L2	0.000967781	0.006062302	-0.648162095
NM_052950	WDFY2	0.006355485	0.027835808	-0.644314577
NM_006281	STK3	0.00011359	0.000981839	-0.643438488
NM_001365	DLG4	0.003042661	0.015429822	-0.642851987
NM_025259	MSH5	0.000941749	0.005926715	-0.642129824
NM_173678	FAM115C	0.001679933	0.009571046	-0.641464635
NM_001207065	CXADR	0.004787508	0.022236696	-0.640838767
NM_001146032	FCHO2	0.003665875	0.017945726	-0.640597613
NM_001492	GDF1	0.002010878	0.011103169	-0.636604408
NM_021267	CERS1	0.002010878	0.011103169	-0.636604408
NM_003786	ABCC3	0.008914187	0.036413273	-0.63571341
NR_027051	THAP7-AS1	0.010390059	0.041065273	-0.634692815
NM_025224	ZBTB46	0.004308676	0.020424633	-0.634494406
NM_207481	NCKAP5	0.007202734	0.030868711	-0.632355459
NM_144977	DENND1B	0.000259485	0.00200341	-0.630307016
NM_014759	PHYHIP	0.012350638	0.047145009	-0.629112434
NM_001099335	PHYHIP	0.012350638	0.047145009	-0.629112434
NR_027421	FAM27C	0.012366578	0.047193735	-0.627673839
NM_020959	ANO8	0.000212983	0.001688693	-0.626047513
NM_016223	PACSIN3	0.000104898	0.000916032	-0.625547449
NM_001184974	PACSIN3	0.000104898	0.000916032	-0.625547449
NM_012446	SSBP2	0.000684491	0.004552597	-0.625300481
NR_036531	UBAC2-AS1	0.012496258	0.047546381	-0.625276767
NM_133379	TTN	0.000170592	0.00140624	-0.624895681
NM_002918	RFX1	0.011907733	0.045807391	-0.624420752
NM_001174072	SERINC5	0.000263669	0.002028859	-0.623628568

NM_000395	CSF2RB	0.009377103	0.037825354	-0.623207064
NM_058229	FBXO32	0.004972781	0.022925247	-0.622945902
NM_012191	NAT6	0.008035589	0.033601352	-0.622053628
NM_001164711	AMT	0.005351023	0.024255328	-0.621806712
NM_001012984	C16orf86	0.009153011	0.03713311	-0.620666454
NM_014688	USP6NL	0.000892184	0.00565551	-0.619925869
NM_003939	BTRC	0.000308686	0.002319399	-0.619597113
NM_001143779	IFT81	0.005538957	0.024928243	-0.617864858
NR_015454	MAFG-AS1	0.000700389	0.004634088	-0.617741141
NM_001159643	MCTP2	0.000103282	0.000903781	-0.616200942
NM_001256732	SSBP2	0.000828888	0.005322399	-0.614411425
NM_001178055	PARP8	0.000193409	0.00155591	-0.614053141
NM_002119	HLA-DOA	0.000736087	0.004820254	-0.613503581
NM_033637	BTRC	0.000316832	0.002370414	-0.612848875
NM_015159	FAM168A	0.000119805	0.001028084	-0.612679121
NM_001136049	LMLN	0.012203089	0.046716648	-0.612210271
NR_027422	FAM27B	0.008423564	0.034846988	-0.610571674
NM_052885	SLC2A13	0.000113909	0.000984305	-0.609499959
NM_138782	FCHO2	0.006261998	0.027503367	-0.607889512
NM_014901	RNF44	0.000735558	0.004819973	-0.607271447
NM_001164712	AMT	0.007172039	0.030746029	-0.607269013
NM_015184	PLCL2	0.000364382	0.002676972	-0.605970889
NM_025261	LY6G6C	0.012501765	0.047556958	-0.605407357
NM_016049	FAM158A	0.000337045	0.002505871	-0.604797347
NM_170678	ITGB1BP3	0.006767849	0.029326357	-0.60343627
NM_001012334	MDK	0.000917453	0.005790983	-0.603108557
NM_207304	MBNL2	0.000222594	0.001754595	-0.602486095
NM_178031	TMEM132A	0.000108525	0.000942721	-0.601994242
NM_017870	TMEM132A	0.000108525	0.000942721	-0.601994242
NM_001244364	RGNEF	0.000461609	0.00327781	-0.600731915
NM_001584	MPPED2	0.009299011	0.03756133	-0.599902529
NM_001940	ATN1	0.001146424	0.006991231	-0.598972066
NM_025259	MSH5	0.005214509	0.023766806	-0.597767768
NR_037846	SAPCD1	0.005214509	0.023766806	-0.597767768
NM_001102426	TBC1D8	0.012000013	0.046084825	-0.597546547
NR_037846	SAPCD1	0.001328406	0.007887364	-0.595880792
NM_004115	FGF14	0.012410901	0.047308204	-0.5956196
NM_175929	FGF14	0.012410901	0.047308204	-0.5956196
NM_024615	PARP8	0.000260022	0.002006513	-0.595294741
NM_000481	AMT	0.006411356	0.028039187	-0.594655468
NR_028435	AMT	0.006411356	0.028039187	-0.594655468

NM_207115	ZNF580	0.00120178	0.007269145	-0.594629136
NR_034178	SRGAP2P2	0.0019201	0.010675326	-0.593372016
NM_001144382	PLCL2	0.000384504	0.002803315	-0.592188169
NM_001190201	CES4A	0.002381332	0.012713986	-0.591960908
NM_015076	CDK19	0.006412446	0.028039826	-0.591927557
NM_001184975	PACSIN3	0.000382021	0.002790691	-0.591874756
NM_172166	MSH5	0.006106929	0.026927454	-0.591588445
NM_172165	MSH5	0.006106929	0.026927454	-0.591588445
NM_001256312	STK3	0.000577682	0.003951885	-0.59145188
NM_001007026	ATN1	0.001434023	0.008388752	-0.590589576
NM_001201402	GALC	0.011576052	0.044821569	-0.590379988
NM_021937	EEFSEC	0.000192603	0.001551528	-0.589207673
NM_000203	IDUA	0.010369035	0.041013793	-0.588795151
NM_001198999	SEMA6D	0.003889942	0.018795	-0.588733953
NM_015209	KAZN	0.001720209	0.009766805	-0.588438006
NM_024660	IGFLR1	0.000851596	0.005435329	-0.588048782
NM_152228	TAS1R3	0.010646375	0.041843452	-0.587039
NM_198207	CERS1	0.002709221	0.014104753	-0.585346059
NM_001242463	FBXO32	0.010076722	0.040092373	-0.583927749
NM_021202	TP53INP2	0.006865073	0.029695689	-0.581939805
NM_014735	PHF16	0.002135596	0.011666084	-0.58171345
NM_001207064	CXADR	0.009114829	0.037023699	-0.581712296
NM_001199098	BAIAP3	0.000178801	0.001460136	-0.58150743
NM_001199099	BAIAP3	0.000178801	0.001460136	-0.58150743
NM_001256735	SSBP2	0.002218323	0.012022964	-0.580550442
NM_153697	ANKRD44	0.001391123	0.008186563	-0.58034092
NM_153498	CAMK1D	0.000198465	0.001591846	-0.580025113
NM_002441	MSH5	0.007548896	0.032010637	-0.579990768
NM_024646	ZYG11B	0.000614047	0.004178526	-0.579755994
NM_001135707	ACBD4	0.00135146	0.007998672	-0.579406027
NM_001144951	GLYCTK	0.011091698	0.043295939	-0.579152672
NM_003933	BAIAP3	0.000185482	0.001505999	-0.578820894
NM_001199097	BAIAP3	0.000198964	0.001594558	-0.578579667
NM_014055	IFT81	0.006045885	0.026708125	-0.577804066
NM_000153	GALC	0.012383256	0.047245246	-0.576836882
NR_045553	THBS3	0.002397509	0.012786569	-0.576785788
NM_003793	CTSF	0.000593824	0.004052982	-0.576025748
NM_145253	FAM100A	0.011409256	0.044310884	-0.573803844
NM_152363	ANKLE1	0.000614748	0.004182344	-0.573703842
NM_018349	MCTP2	0.000272877	0.002085751	-0.573683428
NM_016368	ISYNA1	0.000181381	0.001476736	-0.572947126

NM_001178056	PARP8	0.000404446	0.002932873	-0.572377443
NM_182899	CREB5	0.012705129	0.048157947	-0.571855918
NM_182898	CREB5	0.012705129	0.048157947	-0.571855918
NM_004904	CREB5	0.012705129	0.048157947	-0.571855918
NM_001011666	CREB5	0.012705129	0.048157947	-0.571855918
NM_001256736	SSBP2	0.002792549	0.014445288	-0.571702442
NM_003743	NCOA1	0.000101193	0.000887069	-0.570562107
NM_147233	NCOA1	0.000101193	0.000887069	-0.570562107
NM_001201427	DAAM2	0.001460571	0.008512213	-0.570245768
NR_026702	GLYCTK	0.005966176	0.026410971	-0.570059155
NM_001163423	ZNF580	0.001484598	0.008624424	-0.569752895
NM_004925	AQP3	0.001647432	0.00941657	-0.569673995
NM_001256734	SSBP2	0.00261762	0.013721609	-0.569443221
NM_001244706	CSAD	0.008096093	0.033781467	-0.569145284
NM_153607	C5orf41	0.007884836	0.033099824	-0.569083595
NM_002391	MDK	0.001906647	0.010614393	-0.567522132
NM_015345	DAAM2	0.00145064	0.008464297	-0.56709966
NM_001191061	SLC25A22	0.000115964	0.001000173	-0.565422052
NM_147223	NCOA1	0.000117876	0.001014752	-0.565145822
NM_020902	CAMSAP3	0.000806176	0.005197901	-0.564135825
NM_001080429	CAMSAP3	0.000808632	0.005210346	-0.563893416
NM_130468	CHST14	0.012167977	0.046609408	-0.563846594
NR_046367	EGFL7	0.000497852	0.003500042	-0.563652019
NM_001199096	BAIAP3	0.000294281	0.002225228	-0.563345309
NM_001014765	FBXO44	0.001608583	0.009228234	-0.562796458
NM_024698	SLC25A22	0.000162362	0.001347363	-0.562682325
NR_045110	EGFL7	0.000508264	0.00355725	-0.562050094
NR_045111	EGFL7	0.000508264	0.00355725	-0.562050094
NM_013974	DDAH2	0.004079635	0.019535049	-0.5618948
NM_001012333	MDK	0.002219414	0.012026683	-0.561685275
NM_012334	MYO10	0.000858351	0.005472561	-0.561347365
NM_005528	DNAJC4	0.001597016	0.009177822	-0.56131709
NM_001099755	SYBU	0.000162586	0.001348468	-0.561122718
NM_016215	EGFL7	0.000524581	0.003655091	-0.560830523
NM_001161562	TNIK	0.004978117	0.022930664	-0.560607529
NM_001161561	TNIK	0.004978117	0.022930664	-0.560607529
NM_001161560	TNIK	0.004978117	0.022930664	-0.560607529
NM_015028	TNIK	0.004978117	0.022930664	-0.560607529
NM_033401	CNTNAP4	0.010058986	0.040037891	-0.559399057
NM_201446	EGFL7	0.000588434	0.004018958	-0.557138927
NM_001122772	AGAP2	0.000189547	0.001530306	-0.557061938

NM_001080475	PLEKHM3	0.00353711	0.017441706	-0.556602294
NM_001017395	TMCC1	0.001094194	0.006725163	-0.556105547
NM_001099746	SYBU	0.000200634	0.001606208	-0.555914945
NM_001099749	SYBU	0.000200634	0.001606208	-0.555914945
NR_023380	CCDC144C	0.001225322	0.007373213	-0.555865802
NM_001161563	TNIK	0.005710852	0.025516373	-0.554525613
NM_001161566	TNIK	0.005710852	0.025516373	-0.554525613
NM_001161565	TNIK	0.005710852	0.025516373	-0.554525613
NM_001161564	TNIK	0.005710852	0.025516373	-0.554525613
NM_032042	FAM172A	0.000412373	0.002983806	-0.554371952
NM_020998	MST1	0.002175864	0.011829518	-0.552704236
NM_020397	CAMK1D	0.000756319	0.004924615	-0.552175182
NM_022841	RFX7	0.001528718	0.008852089	-0.552027934
NM_001135956	TRPC4	0.01254159	0.047684035	-0.551428295
NM_015512	DNAH1	0.000178713	0.001460136	-0.549970424
NM_001207063	CXADR	0.012129193	0.046478819	-0.549717123
NM_001135955	TRPC4	0.010242576	0.040610891	-0.549668574
NM_001170938	ISYNA1	0.000384708	0.002804114	-0.547847225
NM_138994	CNTNAP4	0.01188056	0.045727213	-0.547701192
NM_001013436	MPST	0.000365872	0.002685263	-0.547588957
NM_001077445	PHF16	0.003771728	0.018354651	-0.547301429
NM_001136258	SGMS2	0.010167195	0.040387453	-0.54632167
NR_045573	ISYNA1	0.00054161	0.003754381	-0.5458604
NM_001003700	RREB1	0.000107534	0.000935479	-0.545820909
NM_015136	STAB1	0.000696694	0.004617229	-0.54572085
NM_001164755	ASPH	0.005847467	0.025978347	-0.545608799
NM_001163417	FAM172A	0.000627934	0.004253548	-0.545130604
NM_001256308	DTNB	0.000419273	0.003021957	-0.545046965
NM_152754	SEMA3D	0.004881192	0.022583587	-0.544577496
NM_173584	EFCAB4A	0.002847892	0.014673208	-0.543210642
NM_001161574	MAFF	0.003525131	0.017395603	-0.543043683
NM_001131028	ATG10	0.007423535	0.031577649	-0.543005053
NM_052893	BTBD9	0.002212502	0.012000167	-0.541942961
NM_001130517	MPST	0.000416451	0.003005261	-0.541579618
NM_031482	ATG10	0.008221811	0.03418125	-0.540045112
NM_001018000	KAZN	0.003289256	0.016439089	-0.539757639
NM_002119	HLA-DOA	0.003666805	0.017945726	-0.539195617
NM_006642	SDCCAG8	0.000899009	0.005690279	-0.538910574
NM_018196	TMLHE	0.010103573	0.04017769	-0.538538384
NM_001018001	KAZN	0.003737281	0.018239574	-0.53822861
NM_001080	ALDH5A1	0.000643367	0.004340283	-0.537677686

NM_170740	ALDH5A1	0.000643367	0.004340283	-0.537677686
NM_170672	RASGRP3	0.001150125	0.007010461	-0.537453603
NM_147127	EVC2	0.000682448	0.004540029	-0.537188536
NM_014808	FARP2	0.001500241	0.008702451	-0.536968516
NM_183413	FBXO44	0.003122766	0.015763417	-0.53690242
NM_021126	MPST	0.000479479	0.003380631	-0.536431298
NM_006977	ZBTB25	0.010139241	0.040297959	-0.536052576
NM_032824	TMEM87B	0.000198885	0.001594354	-0.535738435
NM_001174095	ZEB1	0.000841608	0.005380608	-0.535369478
NM_001252607	THBS3	0.004510267	0.021177374	-0.535109311
NR_024377	FER1L4	0.004947618	0.02283049	-0.534382025
NM_001093725	MEX3A	0.000572017	0.003923059	-0.53420863
NM_002119	HLA-DOA	0.003252015	0.016288575	-0.534149624
NM_002119	HLA-DOA	0.00012857	0.001093504	-0.533927749
NR_037846	MSH5-SAPCD1	0.005583051	0.025088692	-0.533847938
NM_145262	GLYCTK	0.002986752	0.015203374	-0.532895626
NR_026699	GLYCTK	0.002986752	0.015203374	-0.532895626
NM_033220	TRIM14	0.011114835	0.043357777	-0.532576343
NM_022737	LPPR2	0.005616345	0.025188789	-0.531858778
NM_001174093	ZEB1	0.00065046	0.004375221	-0.531792499
NM_001099272	BTBD9	0.002767329	0.014339446	-0.531377008
NM_006939	SOS2	0.003209184	0.016106625	-0.531144777
NM_001114614	MFGE8	0.003782345	0.018384026	-0.531060084
NR_024038	MPST	0.000528198	0.003677711	-0.530437768
NM_001164754	ASPH	0.008215341	0.034163909	-0.530199804
NM_001017999	KAZN	0.004244358	0.02017428	-0.530095562
NM_130898	CREB3L4	0.002419353	0.012886882	-0.529777544
NM_019600	FAM214A	0.001701014	0.009679453	-0.529428419
NM_033182	FBXO44	0.003350447	0.016697171	-0.529252081
NM_007112	THBS3	0.004872739	0.022558527	-0.528949041
NM_001161573	MAFF	0.005554225	0.024983658	-0.528934465
NM_001253389	ISYNA1	0.000596878	0.004071018	-0.528462904
NM_001145963	SLC12A4	0.000104693	0.000914779	-0.526423434
NM_000512	GALNS	0.001907321	0.010614393	-0.525381655
NM_006257	PRKCQ	0.00311804	0.015744912	-0.525299382
NM_003306	TRPC4	0.012253289	0.046857676	-0.525127103
NM_016179	TRPC4	0.012253289	0.046857676	-0.525127103
NM_001256304	DTNB	0.000453639	0.003230481	-0.525074976
NM_001145962	SLC12A4	0.000113544	0.000981839	-0.525024519
NM_001242409	FAM59A	0.000188671	0.001525646	-0.524589046
NM_022751	FAM59A	0.000188671	0.001525646	-0.524589046

NM_001255980	CREB3L4	0.003077985	0.015579709	-0.524446228
NM_152312	GYLTL1B	0.004089808	0.019577454	-0.52435289
NM_207363	NCKAP5	0.001276694	0.007635677	-0.524348024
NM_001173425	DFNB31	0.000181961	0.001480008	-0.52286328
NM_015404	DFNB31	0.000181961	0.001480008	-0.52286328
NM_001255978	CREB3L4	0.002781409	0.014402359	-0.522785198
NM_001242413	PRKCQ	0.003792708	0.018419335	-0.52209187
NM_001172418	BTBD9	0.004570311	0.021388335	-0.521930621
NM_001081560	DMPK	0.000787356	0.00509424	-0.521386273
NM_022140	EPB41L4A	0.000735972	0.004820254	-0.521372563
NM_016456	TMEM9	0.004062135	0.019457521	-0.521255787
NM_024722	ACBD4	0.001553899	0.008971675	-0.521017162
NM_017947	MOCOS	0.0050496	0.02317112	-0.520705085
NR_026701	GLYCTK	0.003988488	0.019163444	-0.520562624
NM_001135706	ACBD4	0.001451497	0.008467635	-0.520474361
NM_017637	BNC2	0.000422202	0.00304086	-0.520368486
NM_006645	STARD10	0.004157071	0.019832346	-0.520185779
NM_001081562	DMPK	0.000811678	0.005225444	-0.519903442
NM_006037	HDAC4	0.000259086	0.002001884	-0.519258683
NM_001135705	ACBD4	0.001646657	0.00941395	-0.518610664
NM_001252608	THBS3	0.009008867	0.036698629	-0.518319989
NM_005072	SLC12A4	0.000174611	0.0014338	-0.517981249
NM_000875	IGF1R	0.000144432	0.001213138	-0.517908659
NM_015392	NPDC1	0.000375403	0.002748427	-0.517339365
NM_152733	BTBD9	0.004998852	0.023002615	-0.51667042
NM_001170635	LPPR2	0.007522767	0.031918056	-0.516657077
NM_032466	ASPH	0.008150313	0.033979075	-0.516437125
NM_005928	MFGE8	0.003307928	0.016515743	-0.516238236
NM_001170794	BACH2	0.0042915	0.020359275	-0.515734857
NM_004409	DMPK	0.000964186	0.006042326	-0.515605066
NR_045574	ISYNA1	0.000835031	0.005350283	-0.515517504
NM_024507	KREMEN2	0.009275775	0.037487855	-0.514225089
NM_001145961	SLC12A4	0.000206289	0.00164263	-0.514034069
NM_148965	TNFRSF25	0.0075999	0.032190171	-0.513551773
NM_183360	DTNB	0.000412898	0.002985775	-0.513550942
NM_004067	CHN2	0.000172334	0.001419024	-0.512992669
NM_003790	TNFRSF25	0.00762862	0.032293406	-0.512502139
NM_148967	TNFRSF25	0.010550326	0.041559388	-0.511896948
NM_014770	AGAP2	0.000415813	0.003002847	-0.51154081
NM_001139488	RASGRP3	0.001444933	0.008437626	-0.511494065
NM_021907	DTNB	0.00043976	0.003145964	-0.510527475

NM_020859	SHROOM3	0.000252898	0.001960188	-0.510383489
NM_001014979	C16orf93	0.005821261	0.02589677	-0.509798944
NM_001195620	C16orf93	0.012447332	0.047404508	-0.509745058
NM_001159770	SLC39A11	0.000783904	0.005077437	-0.509466866
NM_021916	ZNF70	0.009765714	0.039079952	-0.509269766
NM_016202	ZNF580	0.004049373	0.019403155	-0.509222244
NM_001174101	PRR7	0.005806649	0.0258395	-0.508573978
NM_015833	ADARB1	0.00174267	0.009871698	-0.508549586
NM_172389	NFATC1	0.000189146	0.001528655	-0.508020129
NM_001256303	DTNB	0.000477025	0.003367961	-0.507922858
NM_015188	TBC1D12	0.003041297	0.015425536	-0.507841102
NM_152529	GPR155	0.000820693	0.005275476	-0.507668635
NM_030751	ZEB1	0.00095124	0.005975058	-0.507193276
NM_004318	ASPH	0.001053383	0.00650257	-0.507078855
NM_001174096	ZEB1	0.000949258	0.005966391	-0.506764397
NM_152890	COL24A1	0.000260303	0.002007633	-0.506055595
NM_012338	TSPAN12	0.002140179	0.011681025	-0.505949832
NM_001174094	ZEB1	0.001089279	0.006697728	-0.50589316
NM_015376	RASGRP3	0.002740052	0.014237827	-0.50571429
NM_001166136	EVC2	0.001530225	0.00885909	-0.505624221
NM_001128128	ZEB1	0.001093166	0.006720235	-0.505443792
NM_030567	PRR7	0.004589069	0.021455845	-0.505035318
NM_021140	KDM6A	0.001171972	0.007113457	-0.505002102
NM_012434	SLC17A5	0.001014684	0.006316162	-0.504632074
NM_019052	CCHCR1	0.011588963	0.044865714	-0.504585494
NM_033147	DTNB	0.000502892	0.003525463	-0.504272646
NM_001852	COL9A2	0.004834306	0.022412022	-0.503291918
NR_033953	P2RX7	0.005359059	0.024287808	-0.502061577
NM_001195001	PTPRU	0.001310911	0.007803756	-0.501905368
NM_148966	TNFRSF25	0.010783187	0.04227493	-0.501558833
NM_001497	B4GALT1	0.007955175	0.033338516	-0.500615117
NM_015834	ADARB1	0.003778399	0.018382889	-0.500276073
NM_001253725	KREMEN2	0.010019972	0.03989329	-0.500225223
NM_012323	MAFF	0.007097244	0.03054436	-0.500206095
NM_001161572	MAFF	0.007097244	0.03054436	-0.500206095
NM_172229	KREMEN2	0.011515041	0.044655157	-0.499972765
NM_144985	CDH24	0.002026027	0.011170212	-0.49995715
NM_001033045	GPR155	0.000756333	0.004924615	-0.499831508
NM_139177	SLC39A11	0.000952928	0.005983132	-0.499786942
NM_024519	FAM65A	0.006659389	0.028945016	-0.499281132
NM_001193522	FAM65A	0.006659389	0.028945016	-0.499281132

NM_001243733	VEGFB	0.001888079	0.01053046	-0.499068807
NM_001112	ADARB1	0.002291819	0.012351468	-0.498673797
NM_172387	NFATC1	0.000223596	0.001760625	-0.498601076
NM_000080	CHRNE	0.005874624	0.026075611	-0.498015122
NM_001163152	ETV1	0.000766566	0.004979245	-0.497439931
NM_005704	PTPRU	0.001471195	0.008555677	-0.496659989
NM_133177	PTPRU	0.001471195	0.008555677	-0.496659989
NM_133178	PTPRU	0.001471195	0.008555677	-0.496659989
NM_145007	NLRP11	0.001497	0.008685348	-0.496439637
NR_027140	TNFRSF10B	0.007988967	0.033451898	-0.496198907
NM_001002266	Mar-08	0.005726458	0.025574564	-0.496113882
NM_022478	CDH24	0.00196753	0.010896213	-0.496034795
NM_001128613	NUDT22	0.002524264	0.013331004	-0.495901456
NM_139015	SPPL3	0.003110579	0.015710593	-0.495658493
NM_003377	VEGFB	0.001805417	0.010161284	-0.495310379
NM_001184906	FBXL20	0.001285324	0.007676042	-0.495207423
NM_183412	FBXO44	0.006532511	0.028464316	-0.495181772
NM_001002265	Mar-08	0.002507482	0.013258871	-0.494842938
NM_198584	CA13	0.008064501	0.033694066	-0.494002772
NM_001193524	FAM65A	0.007302114	0.031204619	-0.493915133
NM_012477	WBP1	0.000795407	0.005140735	-0.493768308
NM_016573	GMIP	0.000240165	0.001874366	-0.493717418
NM_001039569	AP1S3	0.007154466	0.030697266	-0.493274366
NM_001105529	ATP8A1	0.004262306	0.02025085	-0.493182684
NM_207351	PRRT3	0.009370451	0.037803649	-0.492705144
NM_014048	MKL2	0.000376657	0.002756246	-0.492598284
NM_033148	DTNB	0.000827546	0.005314933	-0.492319636
NM_015016	MAST3	0.001273726	0.007623628	-0.492273123
NM_152243	CDC42EP1	0.004991705	0.0229804	-0.491850074
NM_001142641	FBRSL1	0.000161451	0.001340551	-0.491798715
NM_172114	CAMK2D	0.000200005	0.001602467	-0.491631733
NM_172115	CAMK2D	0.000201886	0.001614927	-0.491595866
NM_172129	CAMK2D	0.000201886	0.001614927	-0.491595866
NM_001135704	ACBD4	0.003472543	0.017193198	-0.490405616
NM_014831	TRANK1	0.000156756	0.001304877	-0.490353696
NM_001199621	NCOA7	0.001267501	0.00759249	-0.490310756
NM_001012957	DISC1	0.002123185	0.011613229	-0.489807138
NM_183361	DTNB	0.000900644	0.005696985	-0.489608006
NM_021813	BACH2	0.006842916	0.029621404	-0.489595181
NM_145021	Mar-08	0.003492962	0.017277025	-0.489509835
NM_001160230	ADARB1	0.004802023	0.022283218	-0.489475557

NM_144641	PPM1M	0.002523581	0.013331004	-0.488879979
NM_032875	FBXL20	0.001444011	0.008433899	-0.488817769
NM_001163418	FAM172A	0.003905575	0.018856533	-0.488679031
NM_173511	FAM117B	0.010712531	0.042064521	-0.48837353
NM_032344	NUDT22	0.00170117	0.009679453	-0.488140397
NM_001198535	OXR1	0.000177689	0.001454176	-0.487626343
NM_001120	MFSD10	0.000189241	0.001529002	-0.487423949
NM_005533	IFI35	0.000329718	0.002456928	-0.487307069
NR_026845	C21orf119	0.008338834	0.03457585	-0.486759023
NM_001253726	KREMEN2	0.012396163	0.047270212	-0.485641308
NM_194291	TMEM65	0.000884818	0.005616003	-0.485463622
NM_001145923	SCAPER	0.006376831	0.02792024	-0.485276922
NM_005781	TNK2	0.000570785	0.003917323	-0.485038047
NM_152730	C6orf170	0.011781341	0.045429949	-0.485017032
NM_000052	ATP7A	0.000426052	0.003062651	-0.484970184
NM_001159601	RAB28	0.000204955	0.001634631	-0.481527744
NM_006095	ATP8A1	0.005136664	0.023491267	-0.481470314
NM_024770	METTL8	0.000348331	0.002568982	-0.481331671
NM_001146069	MFSD10	0.000205507	0.001637282	-0.480845182
NM_005786	TSHZ1	0.000194808	0.001565467	-0.480595998
NM_001010938	TNK2	0.000735018	0.004818561	-0.480236273
NM_014869	IQSEC1	0.002359144	0.012622736	-0.480184484
NM_021224	ZNF462	0.007024535	0.030270899	-0.480028723
NM_021994	ZNF277	0.010078672	0.040094764	-0.479909399
NM_003890	FCGBP	0.001992355	0.011021372	-0.47983759
NM_015073	SIPA1L3	0.00049934	0.003508844	-0.479561902
NM_001017979	RAB28	0.000223949	0.001762942	-0.479456996
NM_020800	IFT80	0.000142458	0.001198249	-0.47926214
NM_001164540	DISC1	0.0038903	0.018795	-0.47910211
NM_004943	DMWD	0.000190253	0.001534673	-0.479047946
NM_006346	PIBF1	0.000952017	0.005978674	-0.478377529
NM_006162	NFATC1	0.000403212	0.002925355	-0.478062014
NM_020376	PNPLA2	0.001009306	0.006287955	-0.477663271
NM_001142782	MAGI3	0.00069931	0.004630435	-0.477479864
NM_001199620	NCOA7	0.000657646	0.004412568	-0.476078098
NR_036467	IFFO1	0.002312151	0.012431542	-0.475660504
NM_016815	GYPC	0.000584374	0.003994905	-0.475304289
NR_024408	LOC253039	0.006130555	0.0270179	-0.475092144
NM_001255981	CREB3L4	0.00846058	0.034973298	-0.475023439
NR_027674	ADARB1	0.004277413	0.020307029	-0.474887555
NM_001255979	CREB3L4	0.007625195	0.032283506	-0.474679744

NM_080730	IFFO1	0.002798961	0.014461479	-0.474459227
NM_001039670	IFFO1	0.002798961	0.014461479	-0.474459227
NM_001199619	NCOA7	0.000676747	0.004512203	-0.473984974
NM_173078	SLITRK4	0.001279259	0.007649043	-0.473921323
NM_024113	C11orf49	0.009997029	0.039844648	-0.473753204
NM_001003677	C11orf49	0.009997029	0.039844648	-0.473753204
NM_001164537	DISC1	0.002897538	0.014874095	-0.473205198
NM_018662	DISC1	0.002897538	0.014874095	-0.473205198
NM_152900	MAGI3	0.000768593	0.004990227	-0.473196567
NM_001003676	C11orf49	0.007657208	0.032377524	-0.472873113
NM_152686	DNAJC18	0.012670751	0.0480767	-0.471321904
NM_006295	VARS	0.000518763	0.003623054	-0.470685549
NM_032591	SLC9A7	0.009890523	0.039452444	-0.470620398
NM_001193457	IFFO1	0.003022228	0.015356253	-0.46980858
NM_001242607	NCAM1	0.007502628	0.0318508	-0.469529206
NM_181351	NCAM1	0.007502628	0.0318508	-0.469529206
NM_181782	NCOA7	0.001049549	0.006489689	-0.469453147
NM_003842	TNFRSF10B	0.010310375	0.040825239	-0.469188097
NM_001024382	HMBS	0.002050029	0.011281611	-0.468894685
NM_052916	RNF157	0.00019228	0.001549405	-0.468244445
NM_145738	SYNGR1	0.010918669	0.042710291	-0.468206457
NM_007255	B4GALT7	0.000414244	0.002993702	-0.467916457
NM_001164750	ASPH	0.003199717	0.016069964	-0.467722696
NM_001190241	IFT80	0.000217286	0.001719598	-0.467331499
NM_001206484	ATF3	0.002309548	0.012423824	-0.466739524
NM_001122842	NCOA7	0.001136028	0.006939228	-0.466657234
NR_026777	ZNF37BP	0.00011048	0.0009583	-0.466543992
NM_001149	ANK3	0.002425446	0.012912393	-0.466042882
NM_139076	FAM175A	0.003476702	0.017208053	-0.465979121
NM_024776	PEAK1	0.002716154	0.014128467	-0.46591644
NM_000615	NCAM1	0.007908988	0.033173566	-0.465641333
NM_015556	SIPA1L1	0.001133494	0.006926597	-0.465226565
NM_004249	RAB28	0.000319629	0.002388935	-0.465048104
NM_147187	TNFRSF10B	0.01111177	0.043357203	-0.464954375
NM_032499	C15orf41	0.008399056	0.034762498	-0.464796153
NM_031413	CECR2	0.00074814	0.004883038	-0.464694557
NM_001166271	SPATA13	0.000689655	0.004577725	-0.463567538
NM_002101	GYPC	0.000575221	0.003940489	-0.463137712
NM_001256584	GYPC	0.000575221	0.003940489	-0.463137712
NM_002917	RFNG	0.001363663	0.008053252	-0.462240732
NR_028080	FAM172A	0.006497223	0.028341422	-0.462003448

NM_001206488	ATF3	0.002489457	0.013172936	-0.46174321
NM_001184883	PLCB3	0.000142371	0.001197861	-0.460820873
NM_014934	DZIP1	0.00028542	0.002164284	-0.459565251
NM_016154	RAB4B	0.010318153	0.040850592	-0.458774916
NM_145886	PIDD	0.000466643	0.00330487	-0.45867863
NM_001168724	TMEM135	0.000112027	0.000969741	-0.457765423
NM_001184749	SLITRK4	0.001163023	0.007070692	-0.457632326
NM_001171133	FAM3A	0.004793115	0.022252306	-0.457001503
NM_001184750	SLITRK4	0.001957269	0.010853549	-0.456530992
NM_032306	ALKBH7	0.00393962	0.018983898	-0.455740096
NM_022918	TMEM135	0.000117973	0.001014998	-0.455151581
NM_144973	DENND5B	0.001385779	0.008161157	-0.455094689
NM_001080448	EPHA6	0.000714726	0.00471256	-0.454748174
NM_001161662	WWC1	0.001053168	0.00650257	-0.454491712
NM_001161661	WWC1	0.001053168	0.00650257	-0.454491712
NM_015238	WWC1	0.001053168	0.00650257	-0.454491712
NM_001082579	RBFOX2	0.000188049	0.001521855	-0.454454809
NM_001082578	RBFOX2	0.000188049	0.001521855	-0.454454809
NM_020843	SCAPER	0.008054628	0.033665172	-0.454363811
NM_018438	FBXO6	0.011313404	0.044022578	-0.454060378
NM_001024647	RAB3IP	0.000728209	0.004783419	-0.454023357
NM_030962	SBF2	0.002666435	0.013925912	-0.454022326
NM_203474	PORCN	0.00549483	0.024767158	-0.453958858
NM_203475	PORCN	0.00549483	0.024767158	-0.453958858
NM_002839	PTPRD	0.003313127	0.016538922	-0.452965992
NM_001005739	VPS54	0.004051562	0.019410006	-0.45277255
NM_001025239	TSPAN4	0.002883095	0.014820437	-0.452726628
NM_001082577	RBFOX2	0.000264826	0.002035813	-0.452566298
NM_014309	RBFOX2	0.000268503	0.002057534	-0.452540996
NM_018226	RNPEPL1	0.000813879	0.005237339	-0.452460554
NM_199334	THRA	0.010481785	0.041366162	-0.452205105
NM_130393	PTPRD	0.004567474	0.021381794	-0.451825346
NM_130392	PTPRD	0.004567474	0.021381794	-0.451825346
NM_130391	PTPRD	0.004567474	0.021381794	-0.451825346
NM_001171025	PTPRD	0.004567474	0.021381794	-0.451825346
NM_001040712	PTPRD	0.004567474	0.021381794	-0.451825346
NM_052924	RHPN1	0.002017365	0.011130714	-0.45181514
NM_001190242	IFT80	0.000673312	0.004493332	-0.451653333
NM_001122870	PPM1M	0.006827261	0.029557942	-0.451341677
NM_001134368	SLC6A6	0.000532379	0.003699887	-0.450604921
NM_021120	DLG3	0.002035183	0.011210292	-0.449166186

NM_003271	TSPAN4	0.003639036	0.017853927	-0.448967721
NM_144571	CNOT6L	0.001020063	0.006343005	-0.448791449
NM_002119	HLA-DOA	0.001484758	0.008624424	-0.448538732
NM_016516	VPS54	0.004372734	0.02065891	-0.448465474
NM_001987	ETV6	0.000441909	0.0031583	-0.448462978
NM_145887	PIDD	0.000595682	0.004063793	-0.448224204
NM_198968	DZIP1	0.000396481	0.002882626	-0.448140039
NM_021021	SNTB1	0.000681105	0.004532664	-0.447874173
NM_001134382	IQSEC1	0.001668023	0.009515959	-0.446908379
NM_024949	WWC2	0.000867765	0.005524288	-0.446886701
NM_001136127	DNM3	0.001718127	0.009756847	-0.446846633
NM_015569	DNM3	0.001718127	0.009756847	-0.446846633
NM_022825	PORCN	0.006154206	0.027106051	-0.446762179
NM_203473	PORCN	0.006154206	0.027106051	-0.446762179
NM_014887	N4BP2L2	0.001330409	0.007897677	-0.446651145
NM_001243960	NEDD4L	0.000137846	0.001165395	-0.446544898
NR_037687	PLXNC1	0.000212839	0.001688002	-0.446425059
NM_014957	DENND3	0.000221257	0.001744522	-0.445727455
NM_000932	PLCB3	0.000247376	0.001923915	-0.444944392
NM_024527	ABHD8	0.003477928	0.017211257	-0.444924706
NM_022092	CHTF18	0.001463094	0.008521904	-0.444289931
NM_001243750	NUDT8	0.005827866	0.02591496	-0.444206499
NM_001204505	DGKH	0.000160856	0.00133636	-0.443846542
NR_033237	FAM3A	0.003281444	0.016408323	-0.443798313
NM_015185	ARHGEF9	0.003840427	0.018608508	-0.443484246
NM_021806	FAM3A	0.003225149	0.016173092	-0.443348561
NM_001031695	RBFOX2	0.000354716	0.002613064	-0.443156621
NM_001082576	RBFOX2	0.000359528	0.00264458	-0.443127662
NM_020461	TUBGCP6	0.000477696	0.003371095	-0.442892724
NR_037945	STX16-NPEPL1	0.000531598	0.003695972	-0.442774904
NM_001204506	DGKH	0.000170473	0.001406053	-0.442434412
NR_027783	SAT1	0.000653334	0.004390577	-0.442260239
NR_033422	SLC11A2	0.001979632	0.010957109	-0.442250601
NR_033948	P2RX7	0.011465087	0.044507901	-0.442104007
NM_003422	MZF1	0.005295032	0.024046008	-0.441777577
NM_177401	MIDN	0.005138844	0.023497619	-0.441730301
NM_032918	RERG	0.000108767	0.000944269	-0.441650961
NR_045786	LOC100861402	0.00014537	0.001219638	-0.441149181
NR_045787	LOC100861402	0.00014537	0.001219638	-0.441149181
NM_147128	ZNRF2	0.001965072	0.010890721	-0.440779302
NM_023078	PYCRL	0.000561752	0.003866944	-0.440750335

NR_038170	FUT8	0.001417294	0.008315444	-0.439605886
NR_024407	LOC100009676	0.004108098	0.019639695	-0.43812272
NM_001253884	ALPK1	0.007390533	0.031482865	-0.438071239
NM_001164213	LRCH1	0.007347713	0.031358897	-0.437787148
NM_181843	NUDT8	0.007131615	0.030616904	-0.437758765
NM_016340	RAPGEF6	0.000735412	0.004819973	-0.437514802
NR_033951	P2RX7	0.01273032	0.048228827	-0.437187354
NM_014925	R3HDM2	0.002458536	0.013041552	-0.437071102
NM_001715	BLK	0.009890659	0.039452444	-0.436714867
NM_024734	CLMN	0.000404983	0.002936055	-0.436570044
NM_001030287	ATF3	0.008609399	0.035450671	-0.43632554
NM_001099281	HEATR7A	0.001015699	0.006320172	-0.436020224
NM_001012758	NUDT17	0.010995555	0.042960152	-0.43578835
NM_001674	ATF3	0.004116292	0.019672539	-0.435394609
NM_001025237	TSPAN4	0.00470738	0.02193052	-0.435174398
NM_001244871	DAB2	0.011306378	0.044006763	-0.435170032
NM_130849	SLC39A4	0.005614821	0.025188789	-0.434593023
NM_001171132	FAM3A	0.004107173	0.019638434	-0.434531013
NM_001025234	TSPAN4	0.004709563	0.021936378	-0.434291804
NR_003003	SCARNA17	0.001215721	0.007338527	-0.433714637
NM_001040619	ATF3	0.004785303	0.022229926	-0.433693469
NM_001039936	CHN2	0.008472987	0.035009976	-0.433274995
NM_001164386	RAPGEF6	0.000837575	0.005358494	-0.432950899
NR_027673	ADARB1	0.008948597	0.03653324	-0.432847861
NM_017667	CCDC132	0.00324647	0.016266286	-0.432519375
NM_198055	MZF1	0.005043011	0.023152444	-0.432404412
NM_014790	JAKMIP2	0.010740027	0.042144644	-0.432164121
NM_001244888	AGAP1	0.005124568	0.023450385	-0.432048975
NM_001079803	GAA	0.001998244	0.011045725	-0.431907048
NM_001204873	NPEPL1	0.012842054	0.04855927	-0.431357335
NM_001113239	HIPK2	0.000103814	0.000907636	-0.431353351
NM_032852	ATG4C	0.010069871	0.040075849	-0.431227071
NM_001025236	TSPAN4	0.00494377	0.022816279	-0.431147812
NM_001025235	TSPAN4	0.00494377	0.022816279	-0.431147812
NM_000152	GAA	0.002145341	0.011693527	-0.4310395
NM_175080	P2RX5	0.009053884	0.036839321	-0.431030736
NM_001204520	P2RX5	0.009053884	0.036839321	-0.431030736
NM_198904	GABRG2	0.009048197	0.036833599	-0.430730015
NM_000816	GABRG2	0.009048197	0.036833599	-0.430730015
NM_012181	FKBP8	0.000368438	0.002702088	-0.430580802
NM_198903	GABRG2	0.009200458	0.037268872	-0.43057042

NM_172058	EYA1	0.011964637	0.045972733	-0.430558309
NM_002561	P2RX5	0.010001272	0.039848881	-0.430257537
NM_001204519	P2RX5	0.010001272	0.039848881	-0.430257537
NM_001037341	PDE4B	0.0002615	0.002014253	-0.430136561
NR_024593	POM121L10P	0.012709787	0.048163153	-0.430031123
NM_205835	LSR	0.00339981	0.016898752	-0.429961455
NM_001079804	GAA	0.001994414	0.011026606	-0.429721886
NM_002958	RYK	0.000664399	0.004445832	-0.429696337
NM_001005861	RYK	0.000664399	0.004445832	-0.429696337
NM_001251852	PIK3R5	0.011530425	0.044685661	-0.429678062
NM_001102406	ALPK1	0.006747805	0.02925657	-0.429345718
NM_144766	RGS13	0.000795883	0.005141708	-0.429106432
NM_015186	VPS13A	0.000417221	0.003009885	-0.429101448
NM_024663	NPEPL1	0.012765444	0.048331088	-0.429066477
NM_001164387	RAPGEF6	0.001200038	0.007260086	-0.42900883
NM_001164388	RAPGEF6	0.001200038	0.007260086	-0.42900883
NM_017767	SLC39A4	0.006191836	0.027239496	-0.428996053
NM_001251855	PIK3R5	0.012229318	0.046802142	-0.428735066
NM_002927	RGS13	0.000891044	0.005650697	-0.428481024
NM_001126054	CASK	0.003465724	0.017165154	-0.427884131
NM_032343	CHCHD6	0.002630584	0.01377499	-0.42785444
NM_024820	DENND1A	0.002694805	0.014044462	-0.427726183
NM_001126055	CASK	0.003426187	0.017009021	-0.427443249
NM_014308	PIK3R5	0.012341301	0.047121476	-0.427405485
NM_001018038	VPS13A	0.000448746	0.003198699	-0.426872724
NM_001171134	FAM3A	0.004375699	0.020669631	-0.426841053
NM_001031712	TRMT11	0.004363694	0.020630491	-0.426692408
NM_001144072	UBAC2	0.000151801	0.001268937	-0.426386399
NM_001099280	HEATR7A	0.001029095	0.006388471	-0.426265434
NM_178221	ATG4C	0.011870099	0.045700953	-0.426072832
NM_002600	PDE4B	0.000312556	0.002343735	-0.42574692
NM_005503	APBA2	0.000231715	0.001816852	-0.425594117
NM_001130414	APBA2	0.000231715	0.001816852	-0.425594117
NM_021998	ZNF711	0.012933863	0.04882566	-0.42508517
NR_033421	SLC11A2	0.003909236	0.018871144	-0.42503532
NM_025029	MZT2B	0.00154539	0.008931224	-0.424991764
NM_207309	UAP1L1	0.001578692	0.009092728	-0.424714873
NM_012140	SLC25A10	0.00143597	0.008396838	-0.424590193
NM_175623	RAB3IP	0.000254258	0.001968681	-0.424588012
NM_015416	LETMD1	0.000766247	0.004979245	-0.424468583
NR_036520	LOC100287042	0.001034948	0.006422122	-0.424168816

NM_003730	RNASET2	0.001593487	0.009159313	-0.424013068
NM_000190	HMBS	0.002097508	0.011491823	-0.423899983
NM_001134773	STX16	0.000148229	0.001242046	-0.423651909
NM_000252	MTM1	0.005033338	0.023118346	-0.423641352
NM_003763	STX16	0.000155179	0.001293175	-0.423580084
NM_080702	BAG6	0.00021822	0.001725611	-0.423096443
NM_014210	EVI2A	0.000564388	0.003881488	-0.422967309
NM_001130026	FAM115C	0.005088756	0.023329613	-0.422803182
NM_080650	ATPBD4	0.009037566	0.036805447	-0.422711724
NM_000092	COL4A4	0.000254961	0.001973093	-0.422469516
NM_153253	SIPA1	0.008631663	0.035522381	-0.421996923
NM_001204868	STX16	0.000337566	0.002507865	-0.421139819
NM_001001433	STX16	0.000149527	0.001251692	-0.421065817
NM_001134772	STX16	0.00015643	0.001302865	-0.420997172
NM_001698	AUH	0.006431579	0.028106948	-0.420865021
NM_001113528	METTL15	0.008248409	0.034277438	-0.420537325
NM_025144	ALPK1	0.007990315	0.033452828	-0.420436185
NM_015925	LSR	0.004395626	0.020757162	-0.420211955
NR_037941	STX16	0.000190113	0.001533963	-0.419970771
NM_017771	PXK	0.000159689	0.001327032	-0.419827562
NM_177454	FAM171B	0.00934937	0.037739095	-0.419705841
NM_004639	BAG6	0.000251795	0.001953172	-0.419656973
NM_080703	BAG6	0.000251795	0.001953172	-0.419656973
NM_002890	RASA1	0.001311848	0.007806178	-0.419479799
NM_000503	EYA1	0.011113627	0.043357777	-0.418386306
NM_180989	GPR180	0.004556873	0.021355715	-0.418100793
NM_177967	UBAC2	0.000388343	0.002827834	-0.418094564
NM_001018037	VPS13A	0.000544853	0.003773339	-0.417604642
NM_205834	LSR	0.004046563	0.019401696	-0.417487511
NM_033305	VPS13A	0.00055043	0.003799567	-0.416432193
NM_006747	SIPA1	0.009416576	0.037945841	-0.416425954
NM_024430	PSTPIP2	0.011690365	0.0451524	-0.415973613
NM_003688	CASK	0.004436136	0.020890383	-0.415512225
NM_130847	AMOTL1	0.000824941	0.005300493	-0.415490517
NR_045018	LETMD1	0.001152377	0.007020011	-0.4152706
NM_001003927	EVI2A	0.000656206	0.00440485	-0.41526096
NM_001174116	DMXL2	0.006966173	0.03006736	-0.415184723
NM_015263	DMXL2	0.006966173	0.03006736	-0.415184723
NM_001174129	SLC11A2	0.003535407	0.01744052	-0.415169749
NM_033396	TNKS1BP1	0.000273857	0.002092621	-0.415151378
NM_001001795	C8orf82	0.002797269	0.01445929	-0.415089149

NM_002039	GAB1	0.007354753	0.031375424	-0.414992003
NM_001243689	LETMD1	0.001060757	0.006541461	-0.414937041
NM_152586	USP54	0.010539231	0.041526695	-0.414472867
NM_153690	FAM43A	0.001599078	0.009184348	-0.414372734
NM_172208	TAPBP	0.001382724	0.008148007	-0.414285623
NM_003172	SURF1	0.000269499	0.0020641	-0.413666863
NM_175625	RAB3IP	0.000330559	0.002461943	-0.413593967
NM_002335	LRP5	0.002093852	0.011478138	-0.41324951
NM_001174128	SLC11A2	0.00369917	0.018089228	-0.412933588
NM_000617	SLC11A2	0.00369917	0.018089228	-0.412933588
NM_014737	RASSF2	0.000167738	0.001386558	-0.412909966
NM_001174125	SLC11A2	0.003816498	0.018507646	-0.412889276
NM_172208	TAPBP	0.002954946	0.015100968	-0.41286018
NM_015023	WDTC1	0.000103213	0.000903442	-0.412259091
NM_001173480	ARHGEF9	0.007907094	0.033173566	-0.411745135
NM_005077	TLE1	0.008314551	0.034513402	-0.410822575
NM_015328	AHCYL2	0.001859236	0.01040311	-0.410635342
NM_001130720	AHCYL2	0.001859236	0.01040311	-0.410635342
NM_001540	HSPB1	0.004549659	0.021328635	-0.410616021
NM_001025238	TSPAN4	0.008695588	0.035735968	-0.410536488
NM_001694	ATP6V0C	0.005757171	0.025676998	-0.409786225
NM_025204	TRABD	0.004043666	0.019390935	-0.409247434
NM_003061	SLIT1	0.006861874	0.029686173	-0.409242953
NM_207123	GAB1	0.008179906	0.034063277	-0.409038998
NM_001204	BMPR2	0.012049554	0.046245203	-0.408998798
NR_026644	UBAC2	0.000352466	0.002597773	-0.408811095
NM_001142885	TMOD2	0.010538286	0.041526695	-0.408593455
NM_020761	RPTOR	0.000667707	0.004463506	-0.40854243
NM_001009998	SSBP4	0.001687065	0.009607995	-0.408148731
NR_037719	PLSCR3	0.011177894	0.043575164	-0.407868999
NM_002314	LIMK1	0.001012	0.006302094	-0.407457796
NM_152636	METTL15	0.010527388	0.041502043	-0.407433521
NM_170774	RASSF2	0.000197231	0.00158323	-0.407272846
NM_172208	TAPBP	0.001385454	0.00816086	-0.406663934
NM_032627	SSBP4	0.001776928	0.0100327	-0.406525144
NM_020319	ANKMY2	0.00042498	0.003057902	-0.406039063
NM_012478	WBP2	0.000780766	0.005060421	-0.405904263
NR_037943	STX16	0.000771426	0.005007529	-0.405818706
NM_134262	RORA	0.001942494	0.010787722	-0.405692302
NM_001105251	ZFYVE16	0.004253518	0.020214584	-0.405465639
NM_001174130	SLC11A2	0.005655691	0.025334667	-0.404337602

NM_001098721	GNG4	0.009828284	0.039277448	-0.403991112
NM_007215	POLG2	0.000832094	0.005333764	-0.403694631
NM_014548	TMOD2	0.011729707	0.04525142	-0.403686751
NM_017699	SIDT1	0.005690546	0.025463931	-0.403441037
NM_007371	BRD3	0.012633199	0.04794646	-0.403421527
NM_001204426	LIMK1	0.001447193	0.008449164	-0.403277832
NM_139245	PPM1L	0.000465945	0.003301499	-0.402345075
NM_001174126	SLC11A2	0.00321792	0.016145014	-0.402201403
NM_001174127	SLC11A2	0.00321792	0.016145014	-0.402201403
NM_001134398	VAV2	0.002990052	0.015214963	-0.401879894
NM_003371	VAV2	0.00299726	0.015249027	-0.401872272
NR_045020	LETMD1	0.002977435	0.015166344	-0.401762392
NM_001784	CD97	0.001505521	0.008729674	-0.401500838
NM_183008	UBXN11	0.006247582	0.027452227	-0.401430391
NM_145345	UBXN11	0.007945087	0.033310404	-0.401256679
NM_024490	ATP10A	0.000176942	0.001449334	-0.400953236
NM_078481	CD97	0.001126197	0.00689051	-0.400249421
NM_001171798	C8orf83	0.012083786	0.046334692	-0.400124434
NM_001017919	RCCD1	0.004978586	0.022930664	-0.399912218
NM_022897	RANBP17	0.010072432	0.040080671	-0.399891461
NM_017983	WIPI1	0.000131709	0.001118285	-0.399867139
NM_001243198	HIP1	0.000136662	0.001156043	-0.399456123
NM_001166278	DLG3	0.003558686	0.017532074	-0.399448382
NM_004946	DOCK2	0.004329127	0.020508318	-0.399146846
NM_005338	HIP1	0.000141069	0.001188705	-0.398393607
NR_045017	LETMD1	0.002545958	0.013431251	-0.398018725
NM_014733	ZFYVE16	0.005178319	0.023641744	-0.397882119
NM_015202	KIAA0556	0.001095115	0.006729429	-0.397523671
NM_014067	MACROD1	0.000211667	0.001680052	-0.397351213
NM_020730	DLG3	0.004405402	0.020793411	-0.397001037
NM_177925	H2AFJ	0.000108497	0.000942721	-0.396849855
NM_001162422	ETS1	0.000172514	0.001420106	-0.396675539
NM_013373	ZDHHC8	0.012801871	0.048438146	-0.395940116
NM_030906	STK33	0.007844465	0.03296761	-0.395066734
NM_001199866	KIF16B	0.00411947	0.019684561	-0.394941597
NM_000136	FANCC	0.002667985	0.013931561	-0.394891925
NM_015015	KDM4B	0.000442355	0.00315997	-0.394624567
NM_018026	PACS1	0.001782338	0.010058062	-0.394452082
NM_005262	GFER	0.004876994	0.022571194	-0.394152122
NM_014749	KIAA0586	0.003385482	0.01683507	-0.393791298
NM_012417	PITPNC1	0.000122252	0.001047564	-0.393770408

NM_033544	RCCD1	0.005291946	0.024038636	-0.392789177
NM_001244193	KIAA0586	0.002884135	0.014823217	-0.392786735
NR_037942	STX16	0.001252243	0.007513204	-0.39273222
NM_005668	ST8SIA4	0.000225786	0.001775991	-0.392500518
NM_001025160	CD97	0.001490796	0.008656112	-0.391317372
NM_133494	NEK7	0.000116888	0.001006828	-0.391306745
NM_201266	NRP2	0.000645796	0.004350739	-0.391258604
NM_003872	NRP2	0.000645796	0.004350739	-0.391258604
NM_001098722	GNG4	0.009784386	0.039133981	-0.391025322
NM_198569	GPR126	0.01128331	0.043945757	-0.390970196
NM_001081563	DMPK	0.010503316	0.041429125	-0.390861404
NM_172208	TAPBP	0.002682421	0.013992191	-0.390828117
NM_001032395	GPR126	0.011870133	0.045700953	-0.390465672
NM_080597	OSBPL1A	0.002126341	0.011626213	-0.39000378
NR_045019	LETMD1	0.002634384	0.013787601	-0.389630762
NM_144718	SPICE1	0.002605317	0.013665457	-0.389412365
NM_013258	PYCARD	0.001268854	0.007597529	-0.389156644
NM_006907	PYCR1	0.000122913	0.001051718	-0.388993353
NM_000154	GALK1	0.003595065	0.017679059	-0.38872587
NM_001166693	AFF1	0.000104599	0.000914224	-0.388173725
NM_001077238	SPPL2B	0.000656347	0.00440485	-0.387946146
NR_029427	WDR13	0.008719275	0.035803339	-0.387738069
NM_015241	MICAL3	0.002131315	0.011646981	-0.387505754
NM_001079669	TMTC4	0.004433027	0.020889775	-0.387188483
NM_004785	SLC9A3R2	0.004707568	0.02193052	-0.387141414
NM_006729	DIAPH2	0.005223678	0.023801296	-0.38695642
NM_004639	BAG6	0.001602241	0.009198954	-0.386883969
NM_080703	BAG6	0.001602241	0.009198954	-0.386883969
NM_080702	BAG6	0.001610895	0.00923793	-0.386703144
NM_153047	FYN	0.000272888	0.002085751	-0.386688443
NM_024112	C9orf16	0.012954148	0.048877402	-0.386604463
NM_005935	AFF1	0.000113523	0.000981839	-0.38621572
NM_001244191	KIAA0586	0.002981753	0.015185733	-0.386107652
NM_201279	NRP2	0.000743352	0.004860325	-0.385623951
NM_001166163	PPP1R9A	0.000234598	0.001835586	-0.385446852
NM_181312	TAZ	0.001453347	0.008475101	-0.385120647
NM_001171796	C8orf83	0.009650854	0.038708924	-0.385112646
NM_006901	MYO9A	0.001618027	0.009272357	-0.384968858
NM_015170	SULF1	0.003547038	0.017483383	-0.384818134
NM_001244189	KIAA0586	0.002787653	0.014427146	-0.383894675
NM_001244192	KIAA0586	0.003005724	0.015279013	-0.383625873

NM_002093	GSK3B	0.000617039	0.004196939	-0.383489427
NM_001146156	GSK3B	0.000619616	0.004210637	-0.383478035
NM_198082	CCDC57	0.00302247	0.015356253	-0.383474352
NM_017650	PPP1R9A	0.0002531	0.001961242	-0.383303013
NM_014738	KIAA0195	0.000351808	0.002593571	-0.383131618
NM_004480	FUT8	0.00866145	0.035605521	-0.38297355
NM_001159547	BEND4	0.000517064	0.003613732	-0.382965427
NM_001080453	INTS1	0.000317184	0.002371411	-0.382926012
NM_001636	SLC25A6	0.000760642	0.004948057	-0.382846177
NM_178167	ZNF598	0.000750154	0.004891888	-0.382557107
NM_001166426	WDR13	0.008274301	0.034365813	-0.382474208
NM_001244190	KIAA0586	0.002949898	0.015082951	-0.382423043
NM_012197	RABGAP1	0.002573651	0.013534097	-0.382376777
NM_002943	RORA	0.004412942	0.020815775	-0.382295223
NM_134261	RORA	0.004412942	0.020815775	-0.382295223
NM_024050	DDA1	0.001427026	0.008358079	-0.382271349
NM_004104	FASN	0.000415227	0.002999346	-0.382259798
NM_181313	TAZ	0.001587542	0.009137512	-0.382219936
NM_152988	SPPL2B	0.000872208	0.005546628	-0.381884698
NM_178155	FUT8	0.005287058	0.02402745	-0.381680577
NM_001163034	RPTOR	0.001611539	0.009239845	-0.381561318
NM_134260	RORA	0.004399915	0.020770815	-0.381507926
NM_017883	WDR13	0.009887981	0.039452356	-0.381102806
NM_017694	MFSD6	0.004522174	0.021220343	-0.381009504
NM_001018073	PCK2	0.000167036	0.001382288	-0.380965262
NM_001160392	TRPT1	0.007732533	0.032631027	-0.380912481
NM_018999	FAM190B	0.010938781	0.042772074	-0.380693262
NM_138385	TMEM129	0.00305522	0.015483	-0.380324019
NM_001142594	ITPK1	0.007668611	0.032411905	-0.380280475
NM_001166161	PPP1R9A	0.000212165	0.001683221	-0.379701239
NM_005160	ADRBK2	0.000745107	0.00486859	-0.379655937
NM_058237	PPP4R4	0.008963643	0.036584615	-0.379468869
NM_004560	ROR2	0.008589278	0.035387157	-0.379408911
NM_001128204	SULF1	0.004289825	0.02035458	-0.379329238
NM_017514	PLXNA3	0.009793295	0.03915028	-0.379210014
NM_152542	PPM1K	0.004506589	0.021163447	-0.379129191
NM_032023	RASSF4	0.000416261	0.003004623	-0.37907417
NM_000116	TAZ	0.001574575	0.009073422	-0.37867431
NM_000156	GAMT	0.003808246	0.018476678	-0.378389898
NM_000218	KCNQ1	0.001630888	0.009337147	-0.378007953
NM_152992	POMZP3	0.0111398	0.04344376	-0.377563482

NM_001080477	ODZ3	0.004196912	0.019990325	-0.377555432
NM_194071	CREB3L2	0.012245771	0.046840979	-0.376218854
NM_153048	FYN	0.000474334	0.003351354	-0.375976566
NM_002065	GLUL	0.00054682	0.003780795	-0.375882366
NM_006339	HMG20B	0.000122622	0.001049527	-0.375849065
NM_032813	TMTC4	0.004100361	0.01961533	-0.375718193
NM_181311	TAZ	0.001737014	0.009843412	-0.375713627
NM_052905	FMNL2	0.000809747	0.005216399	-0.374946378
NM_004095	EIF4EBP1	0.000367699	0.002698	-0.374276532
NM_153265	EML3	0.000512431	0.003584726	-0.374128726
NM_207578	PRKACB	0.000677092	0.004512482	-0.374042973
NM_004639	BAG6	0.001880477	0.010500212	-0.373553379
NM_080703	BAG6	0.001880477	0.010500212	-0.373553379
NM_024704	KIF16B	0.003884456	0.018772872	-0.373442302
NM_001127266	TMEM129	0.002860549	0.014724916	-0.373408293
NM_001033044	GLUL	0.000625961	0.004247258	-0.373308661
NM_001128221	VGLL4	0.000202417	0.001618737	-0.373040737
NM_007309	DIAPH2	0.007156509	0.030698483	-0.372549803
NM_001142649	ANO5	0.005842655	0.025960854	-0.372542405
NM_213599	ANO5	0.005842655	0.025960854	-0.372542405
NM_025009	CEP135	0.007767614	0.032737228	-0.372132569
NM_018474	PLK1S1	0.006779886	0.029369954	-0.371623527
NM_015312	KIAA1109	0.000139057	0.001174631	-0.371612714
NM_139265	EHD4	0.000338849	0.002514429	-0.371401107
NM_001127395	METTL21A	0.010727643	0.042107169	-0.371176488
NM_207406	BEND4	0.000727344	0.004778791	-0.371169795
NM_013301	CCDC106	0.007320566	0.031265485	-0.37110472
NM_032167	SNX29	0.000213483	0.001691754	-0.370921666
NM_001128220	VGLL4	0.000238652	0.00186485	-0.370889859
NM_005052	RAC3	0.000685133	0.004552796	-0.370498137
NM_001164840	LYRM4	0.007350868	0.031367854	-0.370366183
NM_001166162	PPP1R9A	0.000346071	0.002555082	-0.37027786
NM_080702	BAG6	0.00206408	0.011342135	-0.370236514
NM_001163022	PLK1S1	0.009682255	0.038804964	-0.370040142
NM_003801	GPAA1	0.001046594	0.006479509	-0.369867033
NM_001142864	PIEZO1	0.000316759	0.002370414	-0.369795717
NM_001166160	PPP1R9A	0.000288585	0.002184941	-0.369651858
NM_001165417	SLC25A11	0.000290806	0.00220007	-0.369614324
NM_001252076	SLC9A3R2	0.010677975	0.041939913	-0.369578072
NM_001164165	ASB3	0.005046046	0.023162396	-0.36949146
NM_001163023	PLK1S1	0.011861666	0.045689323	-0.369360556

NM_016436	PHF20	0.000275623	0.002103413	-0.368952419
NM_182734	PLCB1	0.001785698	0.010075104	-0.3688515
NM_001174157	ZFAT	0.006134113	0.027029572	-0.368849708
NM_006295	VARS	0.000180336	0.001470244	-0.368510681
NM_001198569	ATP6V0C	0.012819241	0.048485349	-0.368434678
NM_031472	TRPT1	0.003347063	0.016685904	-0.368296138
NM_001130012	SLC9A3R2	0.007650843	0.032359819	-0.36794335
NM_013265	C11orf2	0.002028927	0.011184127	-0.367885775
NM_001033056	GLUL	0.000640952	0.004326865	-0.367673666
NM_006521	TFE3	0.004277754	0.020307029	-0.367376846
NM_003864	SAP30	0.0083976	0.034762498	-0.367170867
NM_001197026	PLEKHA8	0.003130104	0.015792411	-0.365904869
NM_001080497	MEGF9	0.011549224	0.044746844	-0.365716058
NM_015055	SWAP70	0.00322211	0.016163311	-0.365681778
NM_014427	CPNE7	0.00569545	0.025478203	-0.365354596
NM_020410	ATP13A1	0.000172766	0.001421191	-0.365238791
NM_001013841	STAP2	0.001606111	0.009218565	-0.365084067
NM_001105204	RUSC1	0.004223699	0.020098585	-0.36499309
NM_001243403	CLEC16A	0.00275442	0.014287502	-0.364822116
NM_033407	DOCK7	0.002623418	0.013742404	-0.364559501
NM_000944	PPP3CA	0.000678278	0.004518354	-0.364308576
NM_001130691	PPP3CA	0.000684666	0.004552597	-0.364288454
NM_199051	FAM5C	0.001936249	0.010757062	-0.363923418
NM_001160389	TRPT1	0.003759611	0.018309465	-0.363707075
NM_001199865	KIF16B	0.005792066	0.025786191	-0.363500745
NM_001160393	TRPT1	0.004761685	0.02214098	-0.363264921
NM_178156	FUT8	0.009191347	0.037253035	-0.363192936
NM_015175	NBEAL2	0.00278315	0.014408861	-0.362992926
NM_001135751	DERL3	0.000204007	0.001628386	-0.36269397
NM_000254	MTR	0.000126039	0.001072905	-0.362502506
NM_006309	LRRFIP2	0.000745613	0.004869752	-0.362500079
NM_001201965	ASB3	0.005458574	0.024641112	-0.362435877
NM_014667	VGLL4	0.000163654	0.001355812	-0.361908325
NM_001033678	TRPT1	0.003968428	0.019093113	-0.361891914
NR_037648	FOXRED1	0.001778084	0.010035956	-0.361869306
NM_178507	OAF	0.002135215	0.011666084	-0.361707305
NM_001165418	SLC25A11	0.000417502	0.003010656	-0.361643233
NM_001040118	ARAP1	0.001113293	0.00681998	-0.361586379
NM_014875	KIF14	0.000162517	0.001348278	-0.361274817
NM_153636	CPNE7	0.006700325	0.029093155	-0.360866828
NM_005600	NIT1	0.004354248	0.02060383	-0.360509965

NM_001204088	NBL1	0.002186309	0.011877614	-0.360374197
NM_017724	LRRFIP2	0.000962352	0.006033382	-0.360276349
NM_181671	PITPNC1	0.000284967	0.002161396	-0.36015866
NM_138924	GAMT	0.00709236	0.030532184	-0.359797565
NM_005380	NBL1	0.005824744	0.025908385	-0.359482633
NM_182744	NBL1	0.005019473	0.023065361	-0.359042879
NM_001204089	NBL1	0.002919451	0.014950425	-0.358423119
NM_001204086	NBL1	0.005554922	0.024983658	-0.358422933
NM_033100	CDHR1	0.001233408	0.007415169	-0.357974467
NM_175052	ST8SIA4	0.002577625	0.01354803	-0.357325682
NM_012102	RERE	0.011870837	0.045700953	-0.357323616
NM_003562	SLC25A11	0.000427819	0.003073865	-0.357026251
NM_012294	RAPGEF5	0.003788825	0.018403483	-0.356905606
NM_014045	LRP10	0.000320467	0.002393998	-0.356887132
NM_001128205	SULF1	0.007814477	0.03286947	-0.356880833
NM_006453	TBL3	0.005976531	0.026444991	-0.356541545
NM_145182	PYCARD	0.003771977	0.018354651	-0.356433208
NM_001171690	GCAT	0.007691566	0.03248121	-0.356266933
NM_018645	HES6	0.008069644	0.033708968	-0.356218123
NM_001142853	HES6	0.008134137	0.033916395	-0.356179171
NM_001204084	NBL1	0.005421692	0.024523046	-0.356178093
NM_001164773	BCAT2	0.000414657	0.002995957	-0.356171885
NM_001013703	EIF2AK4	0.000277457	0.002114153	-0.356098784
NM_005188	CBL	0.000182843	0.0014862	-0.355907288
NM_006295	VARS	0.000499476	0.00350897	-0.355791574
NM_152641	ARID2	0.000267547	0.002051265	-0.35556932
NM_153828	RTN4	0.000675193	0.004504175	-0.355526757
NM_001135190	ARAP1	0.000892927	0.005659012	-0.355460594
NM_000837	GRINA	0.001248315	0.007492665	-0.355333625
NR_024333	LOC147727	0.001854061	0.010385885	-0.355238105
NM_016208	VPS28	0.000835256	0.00535057	-0.354719888
NM_183057	VPS28	0.000878502	0.005579495	-0.354456181
NM_001160390	TRPT1	0.004923442	0.022736584	-0.354309159
NM_001164389	RAPGEF6	0.012141427	0.046519699	-0.35415974
NM_006799	PRSS21	0.001047823	0.006484414	-0.35411038
NM_144956	PRSS21	0.001047823	0.006484414	-0.35411038
NR_040711	KCNQ1	0.003464556	0.017165092	-0.353840502
NM_001260	CDK8	0.011669529	0.045093866	-0.353624439
NM_001135924	VWDE	0.005659799	0.025349245	-0.353619277
NM_017918	CCDC109B	0.007386417	0.031469843	-0.353588316
NM_015407	ABHD14A	0.005305041	0.024079714	-0.353134121

NM_001042681	RERE	0.012784003	0.048389023	-0.353082447
NM_207520	RTN4	0.000745604	0.004869752	-0.353082321
NM_001201482	OSBPL6	0.005526263	0.024882416	-0.352969011
NM_001134369	LRRFIP2	0.001060163	0.006540347	-0.352597887
NM_004563	PCK2	0.000248855	0.001933394	-0.352513248
NM_001478	B4GALNT1	0.011485294	0.044568879	-0.352503638
NM_144767	AKAP13	0.000340389	0.002521272	-0.352242473
NM_015192	PLCB1	0.0028863	0.014831777	-0.352046436
NM_001185094	NIT1	0.00544491	0.024600787	-0.352009614
NM_015559	SETBP1	0.006698947	0.029091423	-0.351815921
NR_038120	ELMO1	0.000553614	0.003819766	-0.35173007
NM_017547	FOXRED1	0.002920017	0.014950751	-0.351526134
NM_012292	HMHA1	0.003650957	0.017900593	-0.351261343
NM_001128206	SULF1	0.009411849	0.037940511	-0.350877974
NM_001042517	DIAPH3	0.007665958	0.032405301	-0.350703021
NM_005419	STAT2	0.000528523	0.003679106	-0.350020696
NM_001127396	STXBP2	0.001432556	0.00838182	-0.349809768
NM_001009184	GRINA	0.001396626	0.008212017	-0.349518784
NM_198332	STAT2	0.00055689	0.003837026	-0.349124556
NM_015035	ZHX3	0.00029854	0.002255709	-0.349059937
NM_005009	NME4	0.008106627	0.03382067	-0.349028137
NM_201263	WARS2	0.003733854	0.018227987	-0.34890543
NM_001122837	SLC50A1	0.000180194	0.001470244	-0.348810577
NM_032523	OSBPL6	0.005274303	0.02397682	-0.348459865
NM_145159	JAG2	0.005197404	0.023717945	-0.348356336
NM_152663	RALGPS2	0.001166975	0.00709182	-0.347909278
NM_014431	KIAA1274	0.002212906	0.012000167	-0.347677861
NM_001197126	IRF3	0.002685668	0.014004591	-0.34744673
NM_144957	PRSS21	0.00179109	0.010097861	-0.347373024
NM_015836	WARS2	0.003754158	0.0182979	-0.347307879
NM_001220767	IKZF1	0.000780376	0.005060096	-0.347238223
NM_001201480	OSBPL6	0.005587496	0.025104872	-0.346829467
NM_020145	SH3GLB2	0.000760766	0.004948057	-0.346766642
NM_001001132	ITSN1	0.005440077	0.024593264	-0.346499489
NM_181472	CMTM7	0.001102871	0.006767296	-0.346402422
NM_001018076	NR3C1	0.001855781	0.010389648	-0.345940706
NM_145207	SPATA5	0.00033902	0.002514891	-0.345925003
NR_037849	WBP1	0.003337171	0.016639381	-0.345859611
NM_001220770	IKZF1	0.001053289	0.00650257	-0.345803592
NM_006184	NUCB1	0.000186887	0.001514103	-0.345495173
NR_038121	ELMO1	0.000503538	0.003529161	-0.345242061

NM_001130692	PPP3CA	0.001331621	0.007901411	-0.345168777
NM_006949	STXBP2	0.001590947	0.009146481	-0.345145395
NM_001039459	ELMO1	0.000518443	0.003621668	-0.345121385
NM_018660	ZNF395	0.000383358	0.002796898	-0.344794187
NM_001220772	IKZF1	0.003147341	0.015857836	-0.344575661
NM_001206703	SP100	0.006684867	0.029044265	-0.344244828
NM_001220771	IKZF1	0.001587199	0.009137312	-0.344128986
NM_182758	WDR72	0.001672969	0.009538682	-0.344114762
NM_002229	JUNB	0.007156816	0.030698483	-0.3439814
NM_020824	ARHGAP21	0.005466376	0.024665092	-0.343784999
NM_001144958	EFCAB4B	0.005106152	0.023384115	-0.343361096
NM_145739	OSBPL6	0.008046073	0.033634145	-0.343239329
NM_003634	NIPSNAP1	0.000188538	0.001525393	-0.343233912
NM_001178138	TFDP2	0.000546062	0.003779566	-0.342980981
NM_001220766	IKZF1	0.000858121	0.005472271	-0.34293741
NM_017720	STAP2	0.002904589	0.014894852	-0.342691412
NM_015032	PDS5B	0.008761643	0.035950351	-0.342433964
NM_001178139	TFDP2	0.000567032	0.003896067	-0.342215675
NM_021090	MTMR3	0.004233463	0.020135373	-0.342206299
NM_207396	RNF207	0.007252226	0.031045003	-0.342017891
NM_005647	TBL1X	0.001707698	0.009708754	-0.341881471
NM_001220769	IKZF1	0.001155666	0.007033589	-0.341418356
NM_001018077	NR3C1	0.002270154	0.012259162	-0.341344635
NM_001018075	NR3C1	0.002270154	0.012259162	-0.341344635
NM_001018074	NR3C1	0.002270154	0.012259162	-0.341344635
NM_001220768	IKZF1	0.001251484	0.007510165	-0.341323736
NM_001201481	OSBPL6	0.006302247	0.027659707	-0.341220488
NM_174955	ATP2A3	0.000469815	0.00332337	-0.341015583
NM_174956	ATP2A3	0.000469815	0.00332337	-0.341015583
NM_174953	ATP2A3	0.000465209	0.003298642	-0.340973333
NM_174954	ATP2A3	0.000465209	0.003298642	-0.340973333
NM_020863	ZFAT	0.008317966	0.034513402	-0.340959173
NM_015242	ARAP1	0.001563496	0.009018327	-0.340953411
NM_014819	PJA2	0.00017685	0.001449263	-0.340904096
NM_001256609	C1orf85	0.001179202	0.007148582	-0.340839442
NR_024048	TAZ	0.00421772	0.020078676	-0.340824007
NM_020458	TTC7A	0.002572258	0.013529165	-0.340454132
NM_174957	ATP2A3	0.000501183	0.003517634	-0.340258913
NM_005173	ATP2A3	0.000501183	0.003517634	-0.340258913
NM_005920	MEF2D	0.005169963	0.02361085	-0.340257155
NM_001139468	TBL1X	0.00206599	0.011344239	-0.340017924

NM_001139467	TBL1X	0.00206599	0.011344239	-0.340017924
NM_002226	JAG2	0.005489748	0.024755515	-0.339936931
NM_001139466	TBL1X	0.002064616	0.011342984	-0.339793013
NM_001122839	SLC50A1	0.000234375	0.001834323	-0.339535592
NM_001114752	CD55	0.002178678	0.01184265	-0.339425372
NM_001080123	PRNP	0.002521545	0.013323747	-0.339144038
NM_203463	CERS6	0.000110989	0.000962149	-0.339119523
NM_001256126	CERS6	0.000110989	0.000962149	-0.339119523
NM_031471	FERMT3	0.001802625	0.010151335	-0.339104831
NM_199069	NDUFAF3	0.001607528	0.009223966	-0.338867992
NM_144580	C1orf85	0.001192542	0.007219144	-0.33884157
NM_139244	STXBP5	0.007795732	0.032818497	-0.338555682
NM_138766	PAM	0.000194582	0.001564074	-0.338414913
NM_178443	FERMT3	0.001865771	0.010433782	-0.338128865
NM_020532	RTN4	0.001144637	0.006981772	-0.337354544
NM_133452	RAVER1	0.002951452	0.0150883	-0.337165787
NM_174958	ATP2A3	0.000574523	0.003938435	-0.3369355
NM_015033	FNBP1	0.001426583	0.008358079	-0.33685055
NM_001220774	IKZF1	0.002304461	0.01240385	-0.336684522
NM_138423	CASC4	0.001448649	0.008454338	-0.336305634
NM_207111	RNF216	0.000531512	0.003695972	-0.336058177
NM_003024	ITSN1	0.011364545	0.044192645	-0.335859011
NM_174911	FAM84B	0.001562355	0.009016996	-0.33572351
NM_001135629	PPP1R21	0.007364719	0.031395402	-0.335639457
NM_001242803	BTN3A3	0.008514896	0.035153817	-0.335556376
NM_001185093	NIT1	0.007597181	0.032190171	-0.335415504
NM_130439	MXI1	0.000163911	0.001357567	-0.335368941
NM_024940	DOCK5	0.000433041	0.003102384	-0.335192166
NM_001163258	FAM63A	0.006523767	0.028434554	-0.335091185
NM_199442	COPE	0.001340434	0.007939743	-0.335070769
NM_001242840	GUK1	0.007430306	0.031588898	-0.335050007
NM_152994	PPP1R21	0.008306833	0.034491288	-0.334994371
NM_207116	RNF216	0.000544672	0.003772968	-0.334989778
NM_001172222	SCMH1	0.005375071	0.024345525	-0.334981582
NM_001105203	RUSC1	0.006497615	0.028341422	-0.334925041
NM_145863	ASB3	0.010474545	0.04134308	-0.334832725
NM_001220776	IKZF1	0.00319779	0.01606572	-0.33456424
NM_000050	ASS1	0.00120858	0.007304324	-0.334273661
NM_153050	MTMR3	0.005600313	0.025149345	-0.334157645
NM_153051	MTMR3	0.005600313	0.025149345	-0.334157645
NM_001080122	PRNP	0.002960616	0.015103968	-0.334142464

NM_001080121	PRNP	0.002960616	0.015103968	-0.334142464
NM_183079	PRNP	0.002960616	0.015103968	-0.334142464
NM_000311	PRNP	0.002960616	0.015103968	-0.334142464
NM_019001	XRN1	0.000154605	0.001289112	-0.33406395
NM_006286	TFDP2	0.000937616	0.00590571	-0.334053131
NM_001127715	STXBP5	0.008834984	0.036193717	-0.333894634
NM_000574	CD55	0.002417176	0.012877594	-0.333607942
NM_001723	DST	0.000339688	0.002517961	-0.333182194
NM_001042604	XRN1	0.000168868	0.001395125	-0.333064859
NM_001202502	NIPSNAP1	0.000270546	0.002070517	-0.332797767
NM_015401	HDAC7	0.000731336	0.004799719	-0.332720073
NM_054012	ASS1	0.001287432	0.007683626	-0.332518551
NM_001100423	SPATS2L	0.00187238	0.010464833	-0.332367026
NM_001008485	SLC41A3	0.003742436	0.018249749	-0.332350515
NM_004272	HOMER1	0.010470071	0.041330911	-0.332291193
NM_017693	BIVM	0.0110128	0.043010563	-0.33226799
NM_197974	BTN3A3	0.005365863	0.024307523	-0.33198643
NM_173630	RTTN	0.000125101	0.001067993	-0.331949762
NM_001098416	HDAC7	0.00071898	0.004736406	-0.33187955
NM_015384	NIPBL	0.002460365	0.013046873	-0.331852906
NM_015535	SPATS2L	0.001899744	0.01058393	-0.331739394
NR_024188	PPP1R21	0.00813259	0.033914704	-0.331638478
NM_014982	PCNX	0.000754193	0.004912836	-0.331559633
NM_006876	B3GNT1	0.011173414	0.043563414	-0.331459996
NM_058195	CDKN2A	0.00674273	0.029243097	-0.331303267
NM_139029	CD151	0.002406134	0.012825664	-0.330971372
NM_004357	CD151	0.002406134	0.012825664	-0.330971372
NM_006295	VARS	0.00121613	0.00733951	-0.33094861
NM_138822	PAM	0.000310631	0.002331657	-0.330699863
NM_002603	PDE7A	0.000227412	0.001787357	-0.330529659
NM_006060	IKZF1	0.001080198	0.006648765	-0.330377389
NM_014835	OSBPL2	0.002143532	0.011687953	-0.330303843
NM_001178141	TFDP2	0.001285309	0.007676042	-0.330066316
NM_133433	NIPBL	0.002733074	0.014206537	-0.329859068
NM_001167583	ZFAT	0.011409863	0.044310884	-0.329853161
NM_014911	AAK1	0.011881786	0.045727213	-0.32983212
NM_001220775	IKZF1	0.003443542	0.017072362	-0.329749249
NM_177974	CASC4	0.002111943	0.011562385	-0.329309931
NM_002121	HLA-DPB1	0.002845702	0.014666271	-0.329203931
NM_032520	GNPTG	0.006249581	0.027456948	-0.328986152
NM_173471	SLC25A26	0.007102957	0.030545452	-0.328953146

NM_001220765	IKZF1	0.001428632	0.008362153	-0.328692074
NM_001080394	KIAA0146	0.000896346	0.005677051	-0.328594915
NM_001202546	CUX1	0.007986467	0.033446144	-0.328449119
NM_001098534	BAG6	0.010513486	0.04145712	-0.328447425
NM_001178140	TFDP2	0.001723702	0.009775751	-0.328444208
NM_001193475	PPP1R21	0.010739579	0.042144644	-0.328249768
NM_003190	TAPBP	0.00032513	0.002425785	-0.328105713
NM_001024094	NR3C1	0.002439414	0.012951952	-0.328011304
NM_000176	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204258	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204259	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204261	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204262	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204263	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204264	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001204260	NR3C1	0.002439414	0.012951952	-0.328011304
NM_001100422	SPATS2L	0.002005381	0.011078996	-0.327986591
NM_020679	MIF4GD	0.001459824	0.008511201	-0.32795817
NM_019020	TBC1D16	0.004436062	0.020890383	-0.327944572
NM_014920	ICK	0.001666253	0.009509513	-0.327290073
NM_001407	CELSR3	0.002570123	0.013529065	-0.327252222
NM_001029939	ZFAT	0.011945917	0.045906738	-0.327187714
NM_001177306	PAM	0.000309635	0.002324794	-0.326925058
NM_001135861	PHPT1	0.002749106	0.01426741	-0.326859246
NM_016459	MZB1	0.000243962	0.001900842	-0.326680619
NM_001206701	SP100	0.00693183	0.029945223	-0.326610178
NM_006994	BTN3A3	0.004813422	0.022325654	-0.326481804
NM_201267	NRP2	0.009705729	0.038871315	-0.326117592
NM_018534	NRP2	0.009705729	0.038871315	-0.326117592
NM_018593	SLC16A10	0.010261674	0.040664405	-0.326054685
NM_001197123	IRF3	0.004095252	0.0195972	-0.325880517
NM_001130721	ELOVL6	0.005143142	0.023510035	-0.325739209
NM_139030	CD151	0.003741166	0.018249545	-0.325582147
NM_001039490	CD151	0.003741166	0.018249545	-0.325582147
NM_000919	PAM	0.000327416	0.00244101	-0.325410404
NM_016513	ICK	0.001763719	0.009970028	-0.325195199
NM_001206702	SP100	0.008875929	0.0363064	-0.325159748
NM_016115	ASB3	0.009692138	0.038837817	-0.324608117
NM_001256605	C1orf85	0.002013612	0.011112071	-0.324527565
NM_018426	TMEM63B	0.010241378	0.040610891	-0.324461721
NM_001184808	CD99L2	0.001206474	0.007295131	-0.324450199

NR_028451	BCAT2	0.000721659	0.004748789	-0.324176431
NM_001008486	SLC41A3	0.005744633	0.025631203	-0.324170868
NM_013233	STK39	0.0003689	0.002704812	-0.323631608
NM_007368	RASA3	0.002457688	0.013041552	-0.323506516
NM_138410	CMTM7	0.001903932	0.010603291	-0.323274334
NM_001202543	CUX1	0.005477367	0.024710931	-0.3231007
NM_001100424	SPATS2L	0.002677423	0.013975932	-0.322476915
NM_014291	GCAT	0.0090556	0.036839321	-0.322461671
NM_017836	SLC41A3	0.003273295	0.016373089	-0.32205856
NM_133646	ZAK	0.002302928	0.012397849	-0.321800847
NM_024090	ELOVL6	0.005775375	0.025738873	-0.321695949
NM_005224	ARID3A	0.002009732	0.011100969	-0.32168691
NM_004140	LLGL1	0.007342818	0.031346305	-0.321638328
NM_001197125	IRF3	0.004770773	0.022176294	-0.321628761
NM_004586	RPS6KA3	0.005626895	0.0252323	-0.321611398
NM_001242498	MIF4GD	0.001750059	0.009907885	-0.321558494
NM_001571	IRF3	0.004916239	0.022712673	-0.321502954
NM_002162	ICAM3	0.002741976	0.014245333	-0.321495297
NR_028467	ATXN3	0.012581065	0.047803543	-0.321239654
NM_001197122	IRF3	0.005029318	0.023103453	-0.321083744
NM_002087	GRN	0.002163073	0.011772898	-0.32103107
NM_002610	PDK1	0.00104819	0.006485334	-0.321000061
NM_002346	LY6E	0.003363959	0.016736441	-0.320888487
NM_001127213	LY6E	0.003363959	0.016736441	-0.320888487
NM_033420	C19orf6	0.008389017	0.034735464	-0.320872745
NM_024100	WDR18	0.007841059	0.032962618	-0.320802097
NM_001202545	CUX1	0.010016455	0.039884632	-0.320628292
NM_006929	SKIV2L	0.00386773	0.018716386	-0.32050481
NM_000355	TCN2	0.006655104	0.028934852	-0.320264671
NM_001032364	GGT1	0.004182423	0.019937288	-0.320247894
NM_001256604	C1orf85	0.001964717	0.010890721	-0.320210547
NR_033683	PCYT2	0.005737719	0.025615384	-0.320140172
NM_001903	CTNNA1	0.00062766	0.004253548	-0.320071073
NM_138821	PAM	0.000505126	0.003538622	-0.319699875
NM_080927	DCBLD2	0.007773512	0.032751095	-0.319636372
NM_001190	BCAT2	0.000705447	0.004661066	-0.319627037
NR_033682	PCYT2	0.006104542	0.026927221	-0.319206384
NM_001256435	PCYT2	0.006104542	0.026927221	-0.319206384
NR_033685	PCYT2	0.005705683	0.025508617	-0.319016762
NM_001178142	TFDP2	0.00219492	0.01191568	-0.318859775
NM_030775	WNT5B	0.000628541	0.004256687	-0.318786028

NM_032642	WNT5B	0.000645947	0.004350774	-0.318687043
NM_000321	RB1	0.000555886	0.003830998	-0.318263695
NM_015173	TBC1D1	0.006282195	0.027587997	-0.318177691
NM_198440	DERL3	0.000272796	0.002085751	-0.318168861
NM_000876	IGF2R	0.000175162	0.001437925	-0.318151587
NM_002861	PCYT2	0.006050952	0.026715967	-0.318130451
NM_001184791	PARD3	0.000202504	0.001618997	-0.318063324
NM_001456	FLNA	0.001303587	0.007764822	-0.317995862
NM_001110556	FLNA	0.001305392	0.007774017	-0.317954909
NM_001201473	CORO7	0.008362504	0.034649148	-0.317546942
NR_033440	PAM	0.000442066	0.003158661	-0.317190445
NM_001913	CUX1	0.008860062	0.03626146	-0.317126632
NM_181500	CUX1	0.008860062	0.03626146	-0.317126632
NM_033104	STON2	0.000346208	0.002555452	-0.31682647
NM_001184789	PARD3	0.000255689	0.001977694	-0.316663509
NM_007229	PACSIN2	0.008890554	0.03634121	-0.31656375
NR_028450	BCAT2	0.000758037	0.004933547	-0.316506546
NM_001242500	MIF4GD	0.002355602	0.01260874	-0.316452667
NM_002111	HTT	0.000148251	0.001242046	-0.316091059
NM_172209	TAPBP	0.000699579	0.004631186	-0.315997051
NM_001020825	NR3C1	0.006602147	0.028725623	-0.315976901
NM_198977	ARHGEF1	0.002216784	0.012016812	-0.315621555
NR_045568	IRF3	0.005464236	0.024660724	-0.315510306
NM_001201472	CORO7	0.009238017	0.037362298	-0.31524756
NM_013327	PARVB	0.003801768	0.018454287	-0.315117996
NM_181552	CUX1	0.008821021	0.036151467	-0.315033069
NM_005590	MRE11A	0.001442824	0.008430281	-0.315007143
NM_145320	OSBPL3	0.00010639	0.000927152	-0.314834607
NM_024535	CORO7	0.010795912	0.042304016	-0.314502383
NM_014172	PHPT1	0.004031353	0.019335011	-0.314452786
NM_148414	ATXN2L	0.001789124	0.010092519	-0.314430356
NM_005591	MRE11A	0.001824879	0.010245592	-0.314334239
NR_038911	LOC284889	0.004541878	0.021301602	-0.314230738
NR_037882	TNFRSF6B	0.006044819	0.026707386	-0.31422097
NR_033681	PCYT2	0.006346847	0.027818475	-0.314115139
NM_001256434	PCYT2	0.006346847	0.027818475	-0.314115139
NM_001184917	PCYT2	0.006346847	0.027818475	-0.314115139
NM_148415	ATXN2L	0.001578843	0.009092728	-0.314071903
NM_199070	NDUFAF3	0.001537271	0.008894681	-0.314034455
NM_001202544	CUX1	0.010615887	0.041751231	-0.313604221
NM_001002862	DERL3	0.000290323	0.002196979	-0.313587166

NM_001184787	PARD3	0.000259188	0.002002016	-0.313573532
NM_002843	PTPRJ	0.002845477	0.014666271	-0.313394304
NM_005265	GGT1	0.004458176	0.020979193	-0.313211653
NM_018036	ATG2B	0.001008139	0.006283922	-0.313015894
NM_003113	SP100	0.009403806	0.037917628	-0.312824135
NM_176096	CDK5RAP3	0.000663008	0.004440525	-0.312712861
NM_030802	FAM117A	0.003435564	0.017035649	-0.31238444
NM_001008395	C7orf59	0.008715369	0.03579746	-0.312370288
NR_033289	GK5	0.000337987	0.002510365	-0.312315754
NM_148416	ATXN2L	0.001631338	0.009337147	-0.312130145
NM_001033028	CYFIP1	0.000154162	0.001286139	-0.311863584
NM_001032365	GGT1	0.005050286	0.02317112	-0.311788177
NM_001145008	BTN3A1	0.001404237	0.008249395	-0.311694023
NM_001166112	PNPLA6	0.009431562	0.037993457	-0.311623127
NM_001033026	C19orf6	0.008755028	0.035930559	-0.311505492
NM_003190	TAPBP	0.002272102	0.012267454	-0.311040899
NR_002569	SCARNA9	0.008212686	0.034157646	-0.310976531
NM_002431	MNAT1	0.011260355	0.043867851	-0.310945431
NM_145714	ATXN2L	0.001706852	0.009705804	-0.310638057
NM_001134649	EIF4E3	0.003605708	0.017710882	-0.310488196
NM_001184726	TCN2	0.009057041	0.036839321	-0.309884703
NM_025256	EHMT2	0.005668398	0.025383932	-0.309563747
NM_032378	EEF1D	0.006685448	0.029044265	-0.309027568
NM_001166345	MDFIC	0.007398768	0.031499885	-0.309007127
NM_199072	MDFIC	0.007398768	0.031499885	-0.309007127
NM_001164605	FXYD5	0.000537889	0.003732191	-0.308989582
NM_001242501	MIF4GD	0.003947811	0.019014116	-0.308213622
NM_002336	LRP6	0.00935349	0.037740348	-0.308210752
NM_030587	B4GALT2	0.004521408	0.021220343	-0.308059042
NM_013976	GCDH	0.001491719	0.008659781	-0.307984904
NM_003780	B4GALT2	0.005090003	0.023331732	-0.307318186
NM_001253912	TBC1D1	0.010390342	0.041065273	-0.3070728
NM_033071	SYNE1	0.005040874	0.023149383	-0.306775683
NM_031229	RBCK1	0.01254888	0.047699548	-0.306762972
NM_001020	RPS16	0.006178271	0.027191896	-0.306566544
NM_006702	PNPLA6	0.010761212	0.042205483	-0.306519248
NM_001130053	EEF1D	0.00735248	0.031370231	-0.306340025
NM_001184970	PACSIN2	0.011865609	0.045698587	-0.306106187
NM_007245	ATXN2L	0.001883252	0.01051176	-0.305861234
NM_005962	MXI1	0.000961298	0.006029313	-0.305693657
NM_001199629	MYL6B	0.008921482	0.036432554	-0.305663453

NM_002311	LIG3	0.000872054	0.005546628	-0.305617601
NM_002116	HLA-A	0.002957543	0.015103968	-0.30550874
NM_182961	SYNE1	0.005223436	0.023801296	-0.305362337
NM_018200	HMG20A	0.007938586	0.033287845	-0.305237079
NM_016434	RTEL1	0.011557627	0.044767729	-0.304905067
NM_001823	CKB	0.007680032	0.032446334	-0.304817658
NM_001163484	DCAF11	0.001122315	0.006868172	-0.304709334
NM_022458	LMBR1	0.001934362	0.010748583	-0.304709
NM_013430	GGT1	0.005647155	0.025304058	-0.304539136
NM_006709	EHMT2	0.006552476	0.028542937	-0.304356874
NM_006421	ARFGEF1	0.000927085	0.005845571	-0.304242864
NM_022117	TSPYL2	0.001387585	0.008170175	-0.304167394
NM_014164	FXYD5	0.000716165	0.004719954	-0.304143617
NM_002475	MYL6B	0.010146046	0.040314219	-0.304118685
NM_001005417	B4GALT2	0.004763944	0.022148018	-0.304078645
NM_006442	DRAP1	0.001132574	0.0069224	-0.303720967
NM_004706	ARHGEF1	0.003359632	0.016723313	-0.303690145
NM_022904	RASAL3	0.003647281	0.017885518	-0.303659071
NM_030806	C1orf21	0.003784369	0.018387852	-0.30338978
NM_030934	TRMT1L	0.012822199	0.048490366	-0.303336981
NM_001035507	AGBL5	0.010629477	0.041793619	-0.303236148
NM_001001740	RFWD2	0.000690989	0.004583507	-0.303146216
NM_001134651	EIF4E3	0.005245353	0.023885404	-0.303111217
NM_000398	CYB5R3	0.010205945	0.040487261	-0.303022937
NM_001256608	C1orf85	0.005059534	0.023209968	-0.303015561
NM_078471	MYO18A	0.000218124	0.00172531	-0.302940301
NM_203318	MYO18A	0.000218124	0.00172531	-0.302940301
NM_001146191	MPZL1	0.00030477	0.0022952	-0.302813925
NM_032957	RTEL1	0.012070324	0.046306974	-0.302589113
NM_002415	MIF	0.005761866	0.025690228	-0.302409573
NM_001184794	PARD3	0.001183334	0.00716778	-0.30235655
NM_014616	ATP11B	0.00050552	0.003540548	-0.302240149
NM_005360	MAF	0.000206133	0.001641823	-0.302222176
NM_172209	TAPBP	0.003267415	0.016354687	-0.302196196
NM_199074	NDUFAF3	0.002222722	0.012036277	-0.302051606
NM_144498	OSBPL2	0.00477841	0.022204849	-0.301978911
NM_001109662	C12orf51	0.000617176	0.004196939	-0.301646156
NM_006019	TCIRG1	0.012617254	0.047904297	-0.301641973
NM_002116	HLA-A	0.004841971	0.022437058	-0.301611386
NM_007263	COPE	0.003359348	0.016723313	-0.301607218
NM_001135669	XPR1	0.000376828	0.002756819	-0.301588329

NM_003959	HIP1R	0.003506163	0.017330778	-0.301300841
NR_001298	HLA-DRB6	0.009060237	0.036842236	-0.30126095
NM_006623	PHGDH	0.000286274	0.002169649	-0.301232512
NM_024751	GSTCD	0.003875047	0.018739701	-0.300977517
NM_001134650	EIF4E3	0.005890501	0.026126572	-0.300841466
NM_138394	HNRPLL	0.00010719	0.000932757	-0.300791668
NM_003940	USP13	0.001590409	0.009145161	-0.300724781
NM_001100166	PHACTR2	0.007424472	0.031577649	-0.300468582
NM_005079	TPD52	0.000210279	0.001670815	-0.300435444
NM_001025253	TPD52	0.000213281	0.001690601	-0.300426658
NM_006387	CHERP	0.005296806	0.024046008	-0.300231521
NM_001619	ADRBK1	0.002462865	0.01305177	-0.299827948
NM_144779	FXYD5	0.00082958	0.005323024	-0.299696225
NM_007048	BTN3A1	0.001654665	0.009454274	-0.299494201
NM_001252103	KIF21B	0.002316451	0.012439097	-0.299392427
NM_017596	KIF21B	0.002316391	0.012439097	-0.299392365
NM_153818	PEX10	0.007524564	0.031921123	-0.299335646
NM_004089	TSC22D3	0.002332786	0.012513249	-0.299182981
NM_014679	CEP57	0.001213619	0.007328818	-0.29916217
NM_001243776	CEP57	0.001230898	0.007403076	-0.299138372
NM_001184792	PARD3	0.001106991	0.006786972	-0.299123848
NM_001166113	PNPLA6	0.012529393	0.047649856	-0.299094539
NM_001164475	SLC41A3	0.006712022	0.029135429	-0.299089991
NM_001109891	MAPK3	0.003431623	0.017024633	-0.298932695
NM_000159	GCDH	0.000859546	0.00547783	-0.298881089
NM_001252102	KIF21B	0.00243297	0.012940855	-0.298855144
NM_001252100	KIF21B	0.002432905	0.012940855	-0.298855083
NM_181357	DCAF11	0.001323333	0.00785881	-0.298794915
NM_014721	PHACTR2	0.007775648	0.032752505	-0.298765191
NM_001100165	PHACTR2	0.007102762	0.030545452	-0.298734016
NR_036647	CCDC144B	0.010514598	0.04145712	-0.298677866
NM_213725	RPLP1	0.000115092	0.000993372	-0.298576537
NM_001171660	CYB5R3	0.009782552	0.039133981	-0.298568339
NM_013975	LIG3	0.000590436	0.004030781	-0.298564726
NM_145800	Sep-06	0.003857178	0.018683577	-0.298412702
NM_001003	RPLP1	0.00011189	0.000968992	-0.298353088
NM_207040	TCF12	0.001058796	0.006533272	-0.298110712
NM_020137	GRIPAP1	0.00387507	0.018739701	-0.298058812
NM_002691	POLD1	0.008975058	0.036606067	-0.297968074
NR_028100	DCAF11	0.001421207	0.00833511	-0.29791796
NM_004736	XPR1	0.000347932	0.002566907	-0.297851629

NM_001008487	SLC41A3	0.006961138	0.030054355	-0.297834785
NM_001242868	SLAIN1	0.003450735	0.017099463	-0.297785728
NM_006569	CGREF1	0.000328699	0.002449947	-0.297670445
NM_001135554	EPB41L2	0.002519249	0.013313982	-0.297657756
NM_001184793	PARD3	0.00148208	0.008612236	-0.297597653
NM_199073	NDUFAF3	0.002321551	0.012460835	-0.297496623
NM_021978	ST14	0.001427745	0.008360253	-0.297486867
NM_001100164	PHACTR2	0.007425607	0.031577957	-0.297084277
NM_022748	TNS3	0.00026422	0.00203257	-0.29706736
NM_001135555	EPB41L2	0.002566504	0.013520438	-0.296563412
NM_002617	PEX10	0.008153978	0.033989585	-0.296421453
NM_000528	MAN2B1	0.011645311	0.045042785	-0.296395999
NM_001173498	MAN2B1	0.011645311	0.045042785	-0.296395999
NR_028406	FXYD5	0.00100845	0.006283939	-0.296295487
NM_001040153	SLAIN1	0.007368238	0.031402715	-0.295952186
NM_153827	MINK1	0.001164167	0.007076204	-0.295805937
NM_015340	LARS2	0.001402967	0.008246041	-0.295680373
NM_001134367	SLC6A6	0.000157765	0.001312513	-0.295192014
NM_003043	SLC6A6	0.000157765	0.001312513	-0.295192014
NM_002401	MAP3K3	0.004757781	0.022126286	-0.295121306
NR_003190	USP32P1	0.012295373	0.046988374	-0.294951435
NM_001256265	FLII	0.000197297	0.001583328	-0.294942805
NM_134445	CD99L2	0.005131604	0.023478965	-0.294908999
NM_007326	CYB5R3	0.01086184	0.042521577	-0.294821935
NM_001171661	CYB5R3	0.010966442	0.042857675	-0.294778615
NM_018227	UBA6	0.008283654	0.034399852	-0.294724762
NM_007181	MAP4K1	0.01039763	0.041088612	-0.294386066
NM_001184790	PARD3	0.000663181	0.004440685	-0.294026146
NM_024874	KIAA0319L	0.002494153	0.013195431	-0.293993365
NM_006117	ECI2	0.007800219	0.032824893	-0.29399007
NR_028588	ECI2	0.007800219	0.032824893	-0.29399007
NM_022977	ACSL4	0.003271053	0.016367381	-0.293789963
NM_005514	HLA-B	0.006344151	0.027818475	-0.293747535
NM_001134364	MAP4	0.000141083	0.001188705	-0.293626865
NM_198321	GALNT10	0.004547911	0.021323803	-0.293275444
NM_001166239	CGREF1	0.000482953	0.003402542	-0.293242446
NM_001431	EPB41L2	0.002391149	0.01275723	-0.29299255
NM_199002	ARHGEF1	0.003754852	0.018298284	-0.292992311
NM_022457	RFWD2	0.001086802	0.00668388	-0.292927809
NM_001184788	PARD3	0.000622995	0.004229732	-0.292904975
NM_004458	ACSL4	0.003565153	0.017558654	-0.292846038

NM_001252660	EPB41L2	0.003156294	0.015897557	-0.292758589
NM_016086	STYXL1	0.004073432	0.019508488	-0.292698518
NM_198970	AES	0.000700641	0.004634088	-0.292662013
NM_001130	AES	0.000700641	0.004634088	-0.292662013
NM_001024937	MINK1	0.00134174	0.007945891	-0.292643144
NM_016824	ADD3	0.002611663	0.013692802	-0.292539239
NM_015716	MINK1	0.001425023	0.008354216	-0.292452408
NM_170663	MINK1	0.001426447	0.008358079	-0.292451581
NM_001042600	MAP4K1	0.010812229	0.042355263	-0.292311965
NM_001039547	GK5	0.00112805	0.006899006	-0.292218456
NM_001166010	ECI2	0.007808403	0.032853225	-0.292073012
NM_033198	PIGS	0.001198811	0.007255613	-0.292016129
NM_005788	PRMT3	0.004522274	0.021220343	-0.291975826
NM_017458	MVP	0.007363366	0.031394138	-0.291732327
NM_018379	FAM63A	0.008360184	0.034645039	-0.291684958
NM_003071	HLTF	0.000570354	0.003916178	-0.291660531
NM_144643	SCLT1	0.008641602	0.035543595	-0.291624111
NM_001253826	GALNT14	0.00966601	0.038754022	-0.291514518
NM_018842	BAIAP2L1	0.001235351	0.007422344	-0.291457469
NR_038103	TECR	0.003057205	0.015487722	-0.29144122
NR_038104	TECR	0.00308872	0.015626062	-0.291418904
NM_145802	Sep-06	0.005363497	0.024304214	-0.291373814
NM_001500	GMDS	0.008335367	0.034566298	-0.291322164
NM_001184786	PARD3	0.000566559	0.003893715	-0.291157523
NM_006035	CDC42BPB	0.011535566	0.044699756	-0.291028252
NM_021723	ADAM22	0.00039888	0.002897462	-0.291023059
NM_203390	RBM12B	0.012754056	0.04830457	-0.290773006
NM_206836	ECI2	0.00914082	0.037111533	-0.290769949
NM_031462	CD99L2	0.003126936	0.015781786	-0.290768593
NM_001242614	CD99L2	0.003133532	0.015804339	-0.290764267
NM_001184785	PARD3	0.000626148	0.004247258	-0.290416993
NM_019619	PARD3	0.000626148	0.004247258	-0.290416993
NM_138501	TECR	0.003081747	0.015596098	-0.290341074
NM_004240	TRIP10	0.003182423	0.016004751	-0.289910476
NM_001129819	CYB5R3	0.01232784	0.047082177	-0.289881444
NM_006373	VAT1	0.006959861	0.030053208	-0.289845625
NM_007056	CLASRP	0.008019896	0.03355304	-0.289789301
NM_001142650	HNRPLL	0.000398506	0.002895452	-0.289572653
NM_001121	ADD3	0.003519981	0.017387512	-0.289458637
NM_005312	RAPGEF1	0.000895736	0.005674394	-0.289156178
NM_014868	RNF10	0.000269785	0.002065753	-0.289148904

NM_021722	ADAM22	0.000430966	0.003092552	-0.289016443
NM_016351	ADAM22	0.0004376	0.003132024	-0.289000057
NM_139048	HLTF	0.000722916	0.004754958	-0.288476959
NM_203351	MAP3K3	0.0058305	0.025922347	-0.288467895
NM_001243777	CEP57	0.0020526	0.011285364	-0.288457518
NM_005334	HCFC1	0.010580388	0.041650203	-0.28837418
NM_005115	MVP	0.008320906	0.034520782	-0.288368746
NM_001005332	MAGED1	0.003040342	0.015423324	-0.288332933
NM_013302	EEF2K	0.000122314	0.001047794	-0.288287531
NM_001031694	SCMH1	0.008180826	0.034063277	-0.288211776
NM_001037984	SLC38A10	0.011729324	0.04525142	-0.288199474
NM_198679	RAPGEF1	0.000910068	0.005746808	-0.288117838
NR_028099	DCAF11	0.002277578	0.0122814	-0.287696487
NR_033399	DDX12P	0.010897011	0.042642414	-0.287589784
NM_001130005	ACTN1	0.000191574	0.001544914	-0.287395449
NM_020245	TULP4	0.001510569	0.008755528	-0.28737001
NM_000071	CBS	0.000698472	0.004626947	-0.287334771
NM_001178009	CBS	0.000773886	0.0050224	-0.287179358
NM_001135589	GDAP2	0.012017351	0.046139487	-0.287141266
NM_203386	RNH1	0.009640427	0.038672322	-0.287106504
NM_203388	RNH1	0.010015429	0.039884632	-0.286973777
NM_020141	TMEM167B	0.00788176	0.033096263	-0.286936751
NM_003190	TAPBP	0.00496009	0.022877387	-0.286760265
NM_032118	WDR54	0.01219273	0.046686171	-0.286702285
NM_001206609	SELPLG	0.008070927	0.03370959	-0.2865981
NM_001136135	RPL28	0.002463046	0.01305177	-0.286465083
NM_138352	SAMD1	0.006224103	0.027357148	-0.286091988
NM_001003828	PARVB	0.01025342	0.04063762	-0.285811595
NM_025230	DCAF11	0.002127152	0.011628507	-0.285692673
NM_004667	HERC2	0.002468547	0.013078591	-0.285513732
NM_012236	SCMH1	0.008815516	0.036138875	-0.285095973
NM_203387	RNH1	0.009535929	0.038320378	-0.284799696
NM_016732	RALY	0.00043909	0.003141931	-0.284689767
NM_203389	RNH1	0.00990015	0.039479704	-0.28457219
NM_001243385	PARVB	0.010574625	0.041633033	-0.284551816
NM_003884	KAT2B	0.003100402	0.015677155	-0.2845297
NM_173359	EIF4E3	0.004716529	0.0219585	-0.284344444
NM_001199388	EPB41L2	0.003979778	0.019138322	-0.283992024
NM_001256430	STON2	0.005973969	0.026437592	-0.283729105
NM_198969	AES	0.000970876	0.006079125	-0.283719264
NM_194441	BTN3A1	0.002915243	0.014934026	-0.283666714

NM_001077198	ATG9A	0.006442116	0.028140579	-0.283665754
NM_207293	MBNL1	0.000121869	0.001044584	-0.283568377
NM_015229	KIAA0664	0.003406384	0.016927678	-0.283373227
NM_003006	SELPLG	0.008554291	0.035267462	-0.283301196
NM_017999	RNF31	0.005833371	0.025931231	-0.283261632
NM_020964	EPG5	0.002421651	0.012896809	-0.283259777
NM_001025100	MBP	0.000546291	0.003779566	-0.283122864
NM_001001556	GALK2	0.004354871	0.02060383	-0.282998614
NM_001172218	SCMH1	0.008709958	0.03578279	-0.282703767
NM_002121	HLA-DPB1	0.002702612	0.014075275	-0.28267096
NM_001005333	MAGED1	0.003942269	0.018990501	-0.282528065
NM_006986	MAGED1	0.003942269	0.018990501	-0.282528065
NM_207296	MBNL1	0.000140284	0.00118307	-0.282515515
NM_024085	ATG9A	0.007090514	0.030528657	-0.282244098
NM_006377	UNC13B	0.000246842	0.001920267	-0.282067789
NM_001198869	CAPN1	0.004288017	0.020349249	-0.282065161
NM_001025252	TPD52	0.001420896	0.008334931	-0.281948884
NM_004286	GTPBP1	0.00168514	0.009598873	-0.281767228
NM_152564	VPS13B	0.000567966	0.003901584	-0.2815708
NM_017794	KIAA1797	0.000210657	0.001673378	-0.281559494
NM_001006621	MAPKAP1	0.000289607	0.00219212	-0.280908856
NM_007367	RALY	0.000515517	0.003605467	-0.2808717
NM_005514	HLA-B	0.002476298	0.013112641	-0.280492332
NM_005899	NBR1	0.000554835	0.003826944	-0.280337756
NM_001008541	MXI1	0.002852393	0.014688018	-0.280218957
NM_001178008	CBS	0.000839799	0.005371571	-0.279898014
NM_001130004	ACTN1	0.000203359	0.001624961	-0.279863479
NM_001102	ACTN1	0.000205344	0.001636418	-0.279859525
NM_207297	MBNL1	0.000185949	0.001508558	-0.279788022
NM_003174	SVIL	0.006686133	0.029044265	-0.279736482
NM_000110	DPYD	0.000549406	0.003794261	-0.279657909
NM_001197246	BTN3A2	0.00136343	0.008053252	-0.279629477
NM_032667	BSCL2	0.001411229	0.008283131	-0.27962757
NM_001253835	IGFBP7	0.001116047	0.006832624	-0.279568363
NM_001145009	BTN3A1	0.003027965	0.015378914	-0.27942483
NM_001006620	MAPKAP1	0.000227259	0.001786631	-0.279402679
NM_019903	ADD3	0.005439903	0.024593264	-0.279238354
NM_001193375	NDUFA11	0.012376612	0.047225962	-0.279005587
NM_007103	NDUFV1	0.004799148	0.022276834	-0.278995196
NM_025150	TARS2	0.000301557	0.002275036	-0.278936697
NM_134446	CD99L2	0.006727603	0.029194535	-0.278805385

NM_003655	CBX4	0.011384843	0.044245014	-0.278745458
NM_012154	EIF2C2	0.002164628	0.011777052	-0.278452934
NM_017684	VPS13C	0.003266068	0.016350698	-0.277942464
NM_020821	VPS13C	0.003272206	0.016370396	-0.277939437
NM_031862	NBR1	0.000681189	0.004532664	-0.277614759
NM_001198868	CAPN1	0.004844371	0.022441182	-0.277573537
NM_003162	STRN	0.007612372	0.032233807	-0.27746089
NM_024757	EHMT1	0.004535474	0.021275563	-0.277135781
NM_001199389	EPB41L2	0.005479401	0.024716357	-0.277079197
NM_001168335	ME2	0.00018977	0.001531611	-0.277074558
NM_020921	NIN	0.008398599	0.034762498	-0.27701657
NM_001037333	CYFIP2	0.002881092	0.014813912	-0.276904053
NM_005186	CAPN1	0.005270354	0.023964988	-0.27684393
NM_018303	EXOC2	0.004587292	0.021450916	-0.276774165
NM_001553	IGFBP7	0.000990738	0.006185244	-0.276569552
NM_021738	SVIL	0.006438483	0.028128844	-0.276490583
NM_001037332	CYFIP2	0.003283469	0.016415686	-0.276470409
NM_001172220	SCMH1	0.012154379	0.046563321	-0.276358957
NM_016479	SHISA5	0.004129256	0.019713582	-0.276252815
NM_017890	VPS13B	0.000710026	0.004684689	-0.276159526
NM_001128626	SPIRE1	0.003857916	0.018684106	-0.276124927
NM_031858	NBR1	0.00079444	0.005136721	-0.276070776
NM_152221	CSNK1E	0.006885024	0.029768989	-0.275959566
NR_045602	GALNT14	0.009030403	0.036781318	-0.275805125
NM_024572	GALNT14	0.009100176	0.036969234	-0.275800612
NM_207295	MBNL1	0.000220457	0.001739875	-0.275764179
NM_017432	PTOV1	0.010137439	0.040296186	-0.275598242
NR_024388	LOC152217	0.010002113	0.039848881	-0.275359824
NM_001166102	NDUFV1	0.005296136	0.024046008	-0.2753356
NM_020148	SPIRE1	0.00396871	0.019093113	-0.275293085
NM_001015881	TSC22D3	0.008496511	0.035082788	-0.275210042
NM_003119	SPG7	0.00198698	0.010995735	-0.275146134
NR_040008	CAPN1	0.005203718	0.023743112	-0.27504606
NM_012120	CD2AP	0.007453375	0.031668853	-0.275007203
NM_018080	VPS13C	0.005269656	0.023964988	-0.274920467
NM_001018088	VPS13C	0.005270894	0.023964988	-0.274919873
NM_001145167	PRMT3	0.010742232	0.042147732	-0.274772777
NM_012448	STAT5B	0.001157438	0.007042505	-0.274479134
NM_022373	HERPUD2	0.009319874	0.037630257	-0.274369397
NM_014608	CYFIP1	0.000677078	0.004512482	-0.274256527
NM_002746	MAPK3	0.007738185	0.03264097	-0.274181349

NM_001040056	MAPK3	0.007738185	0.03264097	-0.274181349
NM_198057	TSC22D3	0.008848214	0.036222948	-0.274111209
NM_001172219	SCMH1	0.011937083	0.045890595	-0.274073225
NM_207294	MBNL1	0.000244134	0.001901683	-0.273444125
NR_034166	NDUFA11	0.008114513	0.033848817	-0.273275884
NM_181719	TMCO4	0.01178817	0.045447464	-0.273007108
NM_024605	ARHGAP10	0.004049479	0.019403155	-0.272847992
NM_199444	COPE	0.005243631	0.023884885	-0.27278491
NM_005730	CTDSP2	0.000163373	0.001353861	-0.272671884
NM_203383	RNH1	0.011519314	0.044665901	-0.272616073
NM_005862	STAG1	0.002037986	0.011223655	-0.272283382
NM_175614	NDUFA11	0.008402894	0.034768701	-0.272219489
NM_147157	SIGMAR1	0.001822227	0.010236508	-0.272189129
NM_001894	CSNK1E	0.006788814	0.029404341	-0.271920616
NM_172209	TAPBP	0.007061467	0.030408002	-0.271880428
NM_203384	RNH1	0.011927327	0.045876829	-0.271842508
NM_006828	ASCC3	0.000445023	0.003178261	-0.27183337
NM_033644	FBXW11	0.010191157	0.040456013	-0.271674342
NM_023071	SPATS2	0.008076694	0.033719461	-0.271486184
NM_000973	RPL8	0.005440526	0.024593264	-0.271443009
NM_002939	RNH1	0.011361597	0.044186963	-0.270735969
NM_005908	MANBA	0.008064942	0.033694066	-0.270708489
NM_001130420	SMARCC2	0.000928007	0.005850144	-0.270698315
NM_001719	BMP7	0.002322052	0.012460835	-0.270593393
NM_139045	SMARCA2	0.001640503	0.009382379	-0.27025324
NM_001130702	BSCL2	0.001914299	0.010649048	-0.270053154
NM_001493	GDI1	0.006798685	0.029442806	-0.270050938
NM_203385	RNH1	0.011760036	0.045362537	-0.269905202
NM_017671	FERMT1	0.002918349	0.01494736	-0.269889854
NM_022477	NDRG3	0.003168887	0.015942072	-0.269865559
NM_139067	SMARCC2	0.001206568	0.007295131	-0.269609707
NM_052834	WDR7	0.004908558	0.022685479	-0.269526541
NM_015285	WDR7	0.00491371	0.022705756	-0.269523654
NM_001128219	VGLL4	0.003813915	0.01849814	-0.269368605
NM_001042678	RHOC	0.000962333	0.006033382	-0.269271632
NM_001145166	PRMT3	0.012472834	0.047483371	-0.269182367
NM_003070	SMARCA2	0.001794275	0.010111979	-0.2690853
NM_005640	TAF4B	0.001541204	0.008913966	-0.268714123
NM_002044	GALK2	0.005704152	0.02550561	-0.268689928
NM_002116	HLA-A	0.007126878	0.030614259	-0.268547459
NM_003310	TSSC1	0.004668533	0.021775983	-0.268445408

NM_015528	RNF167	0.003967858	0.019093113	-0.268386994
NM_001164623	EIF2C2	0.003628824	0.017815589	-0.268317693
NM_014376	CYFIP2	0.003894916	0.018811184	-0.268288616
NM_018957	SH3BP1	0.012695195	0.048144859	-0.268180279
NM_033301	RPL8	0.006387881	0.027957092	-0.267771344
NM_001164279	SLC37A4	0.005988166	0.026488585	-0.267220172
NM_001243042	HLA-C	0.009875468	0.039428348	-0.267121579
NM_002117	HLA-C	0.009875468	0.039428348	-0.267121579
NM_032327	ZDHHC16	0.00929226	0.037539163	-0.266708303
NM_033645	FBXW11	0.011847777	0.04564174	-0.266564351
NM_012300	FBXW11	0.011847777	0.04564174	-0.266564351
NM_002396	ME2	0.000531692	0.003695972	-0.266506873
NM_032013	NDRG3	0.003522616	0.017388968	-0.266367394
NM_002117	HLA-C	0.005872432	0.026073666	-0.266349415
NM_032812	PLXDC2	0.008030739	0.033588948	-0.266224514
NM_002116	HLA-A	0.009218119	0.037310655	-0.26614644
NM_020524	PBXIP1	0.000238999	0.001867069	-0.265927363
NM_001171162	ZMYM3	0.011677328	0.045107911	-0.265637649
NM_001467	SLC37A4	0.004819313	0.02234949	-0.265619491
NM_001164280	SLC37A4	0.004950437	0.022839951	-0.265349061
NM_015129	Sep-06	0.007240886	0.031005392	-0.2652286
NM_001100426	RAP1GDS1	0.008530473	0.035183909	-0.265217037
NM_001100427	RAP1GDS1	0.008530473	0.035183909	-0.265217037
NM_021159	RAP1GDS1	0.008530473	0.035183909	-0.265217037
NM_021925	C2orf43	0.012314501	0.047049375	-0.265007941
NM_152740	HIBADH	0.003604002	0.017708703	-0.264895907
NM_015264	KIAA0930	0.012888575	0.048679435	-0.264758858
NM_175744	RHOC	0.001359637	0.008039063	-0.264406013
NM_006282	STK4	0.000588098	0.004017589	-0.264383409
NM_002339	LSP1	0.003474312	0.017199091	-0.264287371
NM_002168	IDH2	0.004322118	0.020478376	-0.264281852
NM_003075	SMARCC2	0.00117553	0.00713214	-0.264276748
NR_026712	RPL13AP5	0.002881328	0.014813912	-0.264276628
NM_005514	HLA-B	0.000634184	0.004287089	-0.264212349
NM_005096	ZMYM3	0.01202026	0.046144693	-0.26399197
NM_015255	UBR2	0.004169305	0.019881135	-0.263896042
NM_001024943	ASL	0.012431476	0.04736684	-0.263847382
NM_001256678	KIAA0391	0.012432871	0.04736684	-0.263820582
NM_001164278	SLC37A4	0.005110979	0.023391802	-0.263574178
NM_005866	SIGMAR1	0.00373825	0.018241311	-0.263468539
NM_130395	WRNIP1	0.008996343	0.036672745	-0.262922904

NR_033688	PEF1	0.007800565	0.032824893	-0.262916248
NM_001042679	RHOC	0.00146789	0.008543907	-0.262790213
NM_147175	HS6ST2	0.004779317	0.02220559	-0.262459812
NM_198046	ZDHHC16	0.00917987	0.037211594	-0.261774189
NM_001128627	SPIRE1	0.007774211	0.032751095	-0.261766012
NM_003190	TAPBP	0.007751577	0.032690502	-0.261742645
NM_198043	ZDHHC16	0.012339358	0.047120112	-0.261562938
NM_001031804	MAF	0.00030939	0.002324103	-0.261452422
NM_052966	FAM129A	0.002139953	0.011681025	-0.26144455
NM_000289	PFKM	0.000125184	0.001068165	-0.261241782
NM_006364	SEC23A	0.00628501	0.027592204	-0.261031828
NM_001077188	HS6ST2	0.005077555	0.023281855	-0.261020459
NM_002116	HLA-A	0.002260959	0.012220609	-0.261018116
NM_033020	TRIM33	0.001234957	0.00742148	-0.260645861
NM_021154	PSAT1	0.001119103	0.006849923	-0.260429078
NM_001164277	SLC37A4	0.006036659	0.026679266	-0.259883719
NM_003818	CDS2	0.003465344	0.017165154	-0.259762164
NM_015906	TRIM33	0.001224264	0.007370633	-0.259689941
NM_207122	EXT2	0.000941696	0.005926715	-0.259331143
NM_198044	ZDHHC16	0.012623506	0.047921913	-0.259107785
NM_005505	SCARB1	0.003307367	0.016515716	-0.25893414
NM_001001329	PRKCSH	0.001411177	0.008283131	-0.258855059
NM_145012	CCNY	0.010198472	0.040471223	-0.258817026
NM_001082533	CA10	0.007273831	0.031114511	-0.258567885
NM_002743	PRKCSH	0.001372218	0.008092395	-0.258351755
NM_012414	RAB3GAP2	0.004363942	0.020630491	-0.258298092
NM_001398	ECH1	0.002864008	0.014740168	-0.258211011
NM_000184	HBG2	0.012902591	0.048726179	-0.258129615
NM_015057	MYCBP2	0.000344971	0.002550122	-0.257684151
NM_022307	ICA1	0.009472698	0.03811267	-0.25750051
NM_001006617	MAPKAP1	0.000354358	0.002611075	-0.257405018
NM_002496	NDUFS8	0.011300776	0.043996486	-0.257083324
NM_014857	RABGAP1L	0.002525136	0.013333237	-0.256830599
NM_015965	NDUFA13	0.006288642	0.027604074	-0.256236809
NM_001013253	LSP1	0.003962133	0.019080003	-0.256099581
NM_145799	Sep-06	0.002912552	0.014925384	-0.256049152
NM_001013255	LSP1	0.004094135	0.019595007	-0.255671352
NM_001082534	CA10	0.008009131	0.03351744	-0.255624543
NR_003010	SCARNA12	0.008062004	0.033691263	-0.255415033
NM_012392	PEF1	0.011523045	0.044674539	-0.255299948
NM_001166269	HAUS4	0.009159959	0.037150719	-0.255291973

NM_017815	HAUS4	0.009140798	0.037111533	-0.255260346
NM_001242932	LSP1	0.004143784	0.019775306	-0.25514982
NM_012233	RAB3GAP1	0.008086541	0.033746348	-0.255097711
NM_001172435	RAB3GAP1	0.008086541	0.033746348	-0.255097711
NM_001013254	LSP1	0.004186048	0.01994642	-0.255092045
NM_006726	LRBA	0.003631758	0.017824105	-0.254972523
NM_199141	CARM1	0.003753224	0.018296353	-0.254667587
NM_001256030	CD48	0.012874145	0.048641218	-0.254350913
NM_001199282	LRBA	0.003588371	0.017649062	-0.254121057
NM_001038702	CDC42SE2	0.002724879	0.014168893	-0.253896714
NM_001197248	BTN3A2	0.002065178	0.011343976	-0.253669354
NM_024044	SLX1B	0.009442456	0.038021879	-0.2535072
NM_001014999	SLX1A	0.009442456	0.038021879	-0.2535072
NM_020178	CA10	0.008401977	0.034768701	-0.253488342
NM_018959	DAZAP1	0.001114838	0.006827957	-0.253458549
NM_001197247	BTN3A2	0.002001361	0.011060896	-0.253299123
NM_170711	DAZAP1	0.001137751	0.006945472	-0.253209578
NM_007047	BTN3A2	0.002118552	0.011592159	-0.253201126
NM_133631	ROBO1	0.000980927	0.006131723	-0.253086936
NM_015937	PIGT	0.000390001	0.002838517	-0.25300642
NM_001668	ARNT	0.000635859	0.004297435	-0.252982531
NM_020135	WRNIP1	0.009834488	0.039296957	-0.252940178
NM_058179	PSAT1	0.000959251	0.006019019	-0.252926735
NM_014203	AP2A1	0.012948892	0.048863776	-0.252844043
NM_130787	AP2A1	0.012948892	0.048863776	-0.252844043
NM_181672	OGT	0.00105222	0.006502149	-0.252702473
NM_014865	NCAPD2	0.000152884	0.001276552	-0.252679673
NR_037672	SERF2	0.00010267	0.00089895	-0.252506567
NM_004599	SREBF2	0.000676555	0.004511937	-0.252472403
NM_001178083	EXT2	0.001315357	0.007820824	-0.252468048
NM_000262	NAGA	0.012125745	0.046474259	-0.252277295
NM_052875	VPS26B	0.001951787	0.010828081	-0.252132175
NM_178427	ARNT	0.000645662	0.004350739	-0.251680609
NM_001197325	ARNT	0.000645662	0.004350739	-0.251680609
NM_002121	HLA-DPB1	0.005713852	0.0255221	-0.251647782
NM_001033853	RPL3	0.000259942	0.002006418	-0.251263533
NM_181673	OGT	0.001012813	0.006305838	-0.251083009
NM_030796	VOPP1	0.000227877	0.001790537	-0.250809563
NM_004194	ADAM22	0.004620004	0.021573328	-0.25052069
NM_004356	CD81	0.010495616	0.041409747	-0.250443962
NM_001197249	BTN3A2	0.002504968	0.013247934	-0.250413842

NM_001184728	PIGT	0.000926631	0.00584395	-0.25029671
NM_001200001	NOTCH2	0.000130872	0.001112131	-0.250136165
NM_006875	PIM2	0.000249175	0.001935371	-0.249943331
NM_005095	ZMYM4	0.003448527	0.017091375	-0.249205135
NM_001166270	HAUS4	0.012308264	0.047031591	-0.249177402
NR_037949	BSCL2	0.003521923	0.017388436	-0.249049041
NR_037948	BSCL2	0.003521923	0.017388436	-0.249049041
NM_005852	CHD3	0.000543285	0.003764238	-0.248965077
NM_002223	ITPR2	0.004891641	0.022624888	-0.248787094
NM_001145845	ROBO1	0.001262503	0.007567126	-0.248782893
NM_001122955	BSCL2	0.003523616	0.017391012	-0.248649258
NM_001206974	DHPS	0.007896564	0.033139697	-0.248002425
NM_021721	ADAM22	0.00504701	0.023163245	-0.247855082
NM_133443	GPT2	0.003206846	0.01609761	-0.247799174
NM_001184729	PIGT	0.00040724	0.002949538	-0.247755517
NM_002941	ROBO1	0.00227441	0.012270993	-0.247755455
NM_138392	SHKBP1	0.008221297	0.03418125	-0.247620805
NR_038370	NDRG3	0.010328255	0.040879695	-0.246858192
NM_023018	NADK	0.008195871	0.034113857	-0.246763695
NM_032750	ABHD14B	0.010357708	0.040979899	-0.246545889
NM_013406	DHPS	0.006456538	0.028191145	-0.246449625
NM_001006619	MAPKAP1	0.000628724	0.004256958	-0.246308162
NM_198196	CD96	0.010637942	0.041815836	-0.246277954
NM_001005273	CHD3	0.000669689	0.004473171	-0.24621156
NM_013335	GMPPA	0.010324957	0.040872086	-0.245904971
NM_003367	USF2	0.006742551	0.029243097	-0.245766364
NM_001080432	FTO	0.005447157	0.024600787	-0.24560586
NM_002123	HLA-DQB1	0.001232329	0.007410183	-0.245121175
NM_024117	MAPKAP1	0.000784752	0.005080712	-0.244622046
NM_017653	DYM	0.00998655	0.039813565	-0.244558468
NM_001243961	HLA-DQB1	0.001271171	0.00760987	-0.244365697
NM_001005271	CHD3	0.000660695	0.00442803	-0.244346285
NM_001012516	ITM2C	0.001425027	0.008354216	-0.244077424
NM_000967	RPL3	0.000305569	0.002298301	-0.243724052
NM_014891	PDAP1	0.003880281	0.018761479	-0.243627462
NM_001146314	ABHD14B	0.011906467	0.045807391	-0.243553319
NM_001144995	CCDC85C	0.011267954	0.043891703	-0.243251342
NM_031407	HUWE1	0.000358296	0.002636171	-0.24311189
NM_001085471	FOXN3	0.001221263	0.007358386	-0.242960791
NM_005816	CD96	0.01171892	0.04522742	-0.242833906
NM_001143830	GAS2	0.010647848	0.041843706	-0.242791261

NM_000992	RPL29	0.000470884	0.00333014	-0.242589104
NM_021629	GNB4	0.0107963	0.042304016	-0.242097923
NM_020240	CDC42SE2	0.003764861	0.018329028	-0.242044885
NM_015902	UBR5	0.000276019	0.002104811	-0.241560145
NM_001199877	SERF2	0.000182123	0.001480755	-0.241198521
NM_005443	PAPSS1	0.009793828	0.03915028	-0.241111362
NM_001184730	PIGT	0.001542496	0.008917966	-0.241033698
NM_005617	RPS14	0.00059955	0.004086426	-0.240868197
NM_022733	SMAP2	0.005946615	0.026340145	-0.240778118
NM_000991	RPL28	0.004088893	0.019576225	-0.240231476
NM_001198995	NADK	0.01046063	0.041304614	-0.240193504
NR_038192	DHPS	0.007434684	0.03159901	-0.23988494
NM_001146333	SUMF2	0.000780733	0.005060421	-0.23978931
NM_020165	RAD18	0.010757574	0.042196781	-0.239755391
NM_001166241	CGREF1	0.006384058	0.027944477	-0.239705047
NM_006633	IQGAP2	0.003059343	0.015493687	-0.23958174
NM_001190965	ZMYM2	0.005641613	0.02528685	-0.239437192
NM_001018108	SERF2	0.000203558	0.001625676	-0.239383073
NM_001198994	NADK	0.008317477	0.034513402	-0.239130638
NM_001083613	TMEM219	0.011882274	0.045727213	-0.239110071
NM_001199876	SERF2	0.000208256	0.001656517	-0.239109942
NM_001198993	NADK	0.00909209	0.036941432	-0.239095462
NM_004824	CDYL	0.007323568	0.031273813	-0.239024078
NM_005514	HLA-B	0.002232432	0.012081804	-0.238924598
NM_005197	FOXN3	0.001742059	0.009870119	-0.238866041
NM_015302	HAUS5	0.005946631	0.026340145	-0.238537397
NM_003331	TYK2	0.009563661	0.038405854	-0.23844441
NM_194280	TMEM219	0.012111535	0.046429112	-0.238382484
NM_172020	POM121	0.008467996	0.034999088	-0.238370414
NM_001605	AARS	0.000654112	0.00439481	-0.238279947
NM_006675	TSPAN9	0.005140872	0.023503278	-0.238082397
NM_001168320	TSPAN9	0.005148219	0.023526008	-0.238080815
NM_198837	ACACA	0.003656804	0.017923346	-0.237986745
NM_002372	MAN2A1	0.002140392	0.011681025	-0.237975983
NM_001930	DHPS	0.008007588	0.033515702	-0.237947763
NM_005907	MAN1A1	0.002821636	0.014559917	-0.237929158
NM_000401	EXT2	0.003002016	0.015265386	-0.237916891
NM_198838	ACACA	0.003515192	0.017366743	-0.237835271
NM_001136134	RPL28	0.00456542	0.021381794	-0.237581618
NM_001242992	PARN	0.00844833	0.034937244	-0.23749891
NM_005028	PIP4K2A	0.002030011	0.011185951	-0.237080153

NM_016145	WDR83OS	0.002116886	0.011585173	-0.237005554
NM_145341	PDCD4	0.000817723	0.005258658	-0.236816838
NM_005993	TBCD	0.011384518	0.044245014	-0.236754536
NM_014456	PDCD4	0.000830337	0.005325947	-0.23621633
NM_001199875	SERF2	0.000251659	0.001953133	-0.235806713
NM_197968	ZMYM2	0.007288905	0.031157133	-0.23575058
NM_001033859	ACADVL	0.008969068	0.036591045	-0.235603316
NM_013396	USP25	0.010947609	0.042795331	-0.235529914
NM_016016	SLC25A39	0.007812606	0.032866252	-0.235484335
NM_207291	USF2	0.008212288	0.034157646	-0.235428915
NM_001728	BSG	0.006497631	0.028341422	-0.235294346
NM_001134477	PARN	0.00842416	0.034846988	-0.234826572
NM_030926	ITM2C	0.002268331	0.012256001	-0.234767211
NM_001143780	SLC25A39	0.007906624	0.033173566	-0.234706182
NM_003453	ZMYM2	0.007644079	0.03234963	-0.234635819
NM_001190964	ZMYM2	0.007677187	0.032438924	-0.234359709
NR_033234	STRBP	0.001167637	0.007094391	-0.234186372
NM_001199492	PDCD4	0.001015753	0.006320172	-0.234167257
NM_001244604	DPYSL2	0.004445562	0.020929779	-0.233723383
NM_017741	DCAF16	0.008041934	0.033621576	-0.233587526
NM_198589	BSG	0.006851007	0.02965211	-0.233583834
NM_001025070	RPS14	0.00078284	0.00507165	-0.233490938
NM_001024	RPS21	0.003934348	0.018964643	-0.233442252
NM_001171137	STRBP	0.001223874	0.007369781	-0.233427362
NM_001025071	RPS14	0.000784371	0.005079354	-0.23332977
NM_018122	DARS2	0.002976024	0.015161754	-0.233287857
NM_001197293	DPYSL2	0.004641021	0.021657857	-0.23282017
NM_001178014	PCCB	0.005182381	0.023656654	-0.23268796
NM_000293	PHKB	0.007516047	0.03189414	-0.232510434
NM_000208	INSR	0.001141778	0.006966601	-0.232450099
NM_001079817	INSR	0.001141778	0.006966601	-0.232450099
NM_002121	HLA-DPB1	0.010432847	0.041211342	-0.232229831
NM_000532	PCCB	0.005351076	0.024255328	-0.232139401
NM_001100619	CABLES1	0.008610659	0.035450671	-0.231683021
NM_000018	ACADVL	0.009413231	0.037940511	-0.231541773
NM_006500	MCAM	0.001221487	0.007358386	-0.231512967
NM_001130158	MYO1B	0.012861689	0.048608775	-0.231220274
NM_001142466	GPT2	0.004355529	0.02060383	-0.231071369
NM_001143971	CDYL	0.008827648	0.036173636	-0.230883657
NM_014155	ZBTB44	0.010896405	0.042642414	-0.230481221
NM_021814	ELOVL5	0.003911137	0.01887558	-0.230338375

NR_026590	CDYL	0.009046484	0.036833599	-0.230056456
NM_002582	PARN	0.010004943	0.039854812	-0.229506058
NM_015411	SUMF2	0.001310131	0.007800676	-0.229429473
NM_018387	STRBP	0.001385444	0.00816086	-0.229385698
NM_001012514	ITM2C	0.002482701	0.013141864	-0.229288134
NM_001042469	SUMF2	0.001428169	0.00836109	-0.229285318
NM_016604	KDM3B	0.00185209	0.010378758	-0.229269091
NM_001242828	ELOVL5	0.004047742	0.019401796	-0.229220488
NM_001136131	APP	0.000207422	0.001651211	-0.228327279
NM_020365	EIF2B3	0.012416242	0.047322489	-0.228122477
NM_001143970	CDYL	0.009522163	0.038280589	-0.228104261
NM_001244580	TRRAP	0.002753546	0.014285463	-0.227371673
NM_001136136	RPL28	0.012266406	0.046901799	-0.226679136
NM_000386	BLMH	0.001460493	0.008512213	-0.226674297
NM_001145933	TKTL1	0.000117916	0.0010148	-0.225930539
NM_198591	BSG	0.004161919	0.019852285	-0.225927492
NM_004635	MAPKAPK3	0.009873694	0.039428348	-0.225643461
NM_006196	PCBP1	0.012435848	0.04736684	-0.225441727
NM_003496	TRRAP	0.002975092	0.015161754	-0.225199216
NM_001166588	EIF2B3	0.012708965	0.048163153	-0.224498167
NM_012253	TKTL1	0.000157908	0.001313337	-0.22410246
NM_001130069	SUMF2	0.002096216	0.011488068	-0.224102369
NM_001031835	PHKB	0.01063315	0.041802531	-0.223978725
NM_032361	THOC3	0.007708043	0.032537862	-0.22383075
NM_198836	ACACA	0.005813643	0.025866751	-0.223665781
NM_001961	EEF2	0.008333402	0.034562975	-0.223494263
NM_001031711	ERGIC1	0.001080602	0.006649877	-0.223418507
NM_001243925	MAPKAPK3	0.010818945	0.042375982	-0.22315634
NM_176801	ADD1	0.00243294	0.012940855	-0.223148157
NM_032815	NFATC2IP	0.007652017	0.032360179	-0.222970907
NM_014190	ADD1	0.002590972	0.01360833	-0.222937007
NM_014189	ADD1	0.002461696	0.013051599	-0.22272636
NM_006612	KIF1C	0.007039681	0.030318582	-0.222588042
NM_001242830	ELOVL5	0.006174365	0.027182758	-0.22251912
NM_001119	ADD1	0.002620492	0.013734241	-0.222514561
NM_024798	SNX22	0.00246267	0.01305177	-0.221915206
NM_031372	HNRPDL	0.00146992	0.008553281	-0.221759271
NM_001039573	SEC14L1	0.011695494	0.04516634	-0.221723475
NM_000922	PDE3B	0.011312714	0.044022578	-0.221365621
NM_004335	BST2	0.005944057	0.026336593	-0.221042265
NM_001199878	SERF2	0.00081544	0.005246253	-0.220947428

NM_022156	DUS1L	0.010541445	0.041529912	-0.220783906
NM_003003	SEC14L1	0.008840032	0.036208045	-0.219921196
NM_001386	DPYSL2	0.006611122	0.028756948	-0.219215082
NM_001640	APEH	0.005995811	0.026518456	-0.219044497
NR_037673	SERF2	0.004355232	0.02060383	-0.218899732
NM_145869	ANXA11	0.008749714	0.03591371	-0.218155001
NM_145868	ANXA11	0.008877591	0.036308197	-0.218134708
NM_016480	PAIP2	0.010383748	0.041050132	-0.218020297
NM_001145934	TKTL1	0.000248213	0.001929915	-0.217670234
NM_001157	ANXA11	0.009007577	0.036698629	-0.21709097
NM_032360	ACBD6	0.011385457	0.044245014	-0.216697802
NM_018979	WNK1	0.012583274	0.047805825	-0.216283514
NM_003486	SLC7A5	0.011326806	0.044063189	-0.215901109
NM_001135243	TCOF1	0.003509653	0.017342259	-0.215773051
NM_001143999	SEC14L1	0.00950909	0.038233205	-0.215214644
NM_001143998	SEC14L1	0.00950909	0.038233205	-0.215214644
NM_006289	TLN1	0.001069192	0.00658921	-0.21518568
NM_001144001	SEC14L1	0.012083281	0.046334692	-0.214541091
NM_003760	EIF4G3	0.012737779	0.048250936	-0.214438388
NM_024665	TBL1XR1	0.010881502	0.04259294	-0.213893206
NM_198834	ACACA	0.008122233	0.033876266	-0.213811654
NM_182762	MACC1	0.001618146	0.009272357	-0.212780743
NM_080546	SLC44A1	0.004916735	0.022712673	-0.21256207
NR_003249	HNRPDL	0.002312534	0.012431542	-0.211821533
NM_001207000	HNRPDL	0.004529452	0.021250667	-0.211795469
NM_001042470	SUMF2	0.002473237	0.013098767	-0.211711588
NM_015909	NBAS	0.003428611	0.017012531	-0.211354274
NM_006353	HMGN4	0.002745566	0.014258996	-0.211145716
NM_032217	ANKRD17	0.008915688	0.036413893	-0.211004016
NM_198839	ACACA	0.009148356	0.037119291	-0.210558078
NM_014313	TMEM50A	0.010359093	0.04097992	-0.21054623
NM_001135244	TCOF1	0.004129523	0.019713582	-0.210263077
NM_001195141	TCOF1	0.004129523	0.019713582	-0.210263077
NM_001135245	TCOF1	0.004370813	0.020653118	-0.210153113
NM_000356	TCOF1	0.004370813	0.020653118	-0.210153113
NM_001008657	TCOF1	0.012074908	0.046318581	-0.209912232
NM_198889	ANKRD17	0.009200958	0.037268872	-0.209748318
NM_018238	AGK	0.010469965	0.041330911	-0.209725477
NM_032635	TMEM147	0.011048681	0.043139359	-0.209204956
NM_033554	HLA-DPA1	0.004542459	0.021301602	-0.209098412
NM_002227	JAK1	0.001723391	0.009775751	-0.208947565

NM_001242597	TMEM147	0.011291416	0.043965803	-0.208473552
NM_001009	RPS5	0.005275628	0.023979171	-0.208322036
NM_001202414	AKR1A1	0.005176062	0.023635069	-0.207128024
NM_002070	GNAI2	0.010010011	0.039869655	-0.206893011
NM_001198801	EIF4G3	0.012080876	0.046334692	-0.206766392
NR_003001	SCARNA7	0.00317131	0.015951561	-0.20660591
NM_004313	ARRB2	0.011034232	0.043088604	-0.206513535
NM_001077488	GNAS	0.001550425	0.008956839	-0.205451734
NM_000516	GNAS	0.001562915	0.009017339	-0.205394571
NM_016021	UBE2J1	0.00091363	0.005768077	-0.205109744
NM_001022	RPS19	0.007896464	0.033139697	-0.204781922
NM_001202413	AKR1A1	0.00541254	0.024489108	-0.20474209
NM_007051	FAF1	0.008911768	0.0364129	-0.204694822
NM_006809	TOMM34	0.008643098	0.035544832	-0.204573666
NM_006066	AKR1A1	0.006136513	0.027036137	-0.203767466
NM_006096	NDRG1	0.0015257	0.008837464	-0.203369003
NM_001981	EPS15	0.011337205	0.04409787	-0.203203771
NM_080426	GNAS	0.001878088	0.010492788	-0.202766167
NM_001077489	GNAS	0.001893074	0.010550729	-0.202707015
NM_001135242	NDRG1	0.001729519	0.009802807	-0.202448466
NM_006311	NCOR1	0.011934377	0.045890307	-0.201994437
NM_153326	AKR1A1	0.006417607	0.028058266	-0.20133756
NM_005892	FMNL1	0.008872892	0.036298972	-0.200220071
NM_001130065	MYO9B	0.006543379	0.028507491	-0.198639518
NM_000997	RPL37	0.000662397	0.004437436	-0.198480453
NM_015236	LPHN3	0.009467441	0.038106996	-0.198047945
NM_001110	ADAM10	0.011390762	0.044259844	-0.197998526
NM_004145	MYO9B	0.006687911	0.029047744	-0.19795049
NM_001042466	PSAP	0.000887105	0.00562932	-0.195668901
NM_002778	PSAP	0.000887546	0.005630918	-0.195668801
NM_057161	KLHDC3	0.011603541	0.044910447	-0.195607825
NM_001042465	PSAP	0.000897936	0.005684695	-0.195513744
NM_181077	GOLGA8A	0.009353489	0.037740348	-0.194788952
NM_001039590	USP9X	0.008829094	0.036174574	-0.194679665
NM_001039591	USP9X	0.008970144	0.036591045	-0.19428313
NM_174908	CCDC50	0.00740282	0.031512622	-0.19410848
NM_006332	IFI30	0.00236105	0.012629588	-0.193342841
NM_001166425	GNAI2	0.012477014	0.047493203	-0.192378996
NM_016592	GNAS	0.003192489	0.016047226	-0.191393815
NR_003259	GNAS	0.002922255	0.014959631	-0.191213963
NM_080425	GNAS	0.003328687	0.016602651	-0.190946989

NM_001077490	GNAS	0.003328687	0.016602651	-0.190946989
NM_004152	OAZ1	0.010456656	0.041297231	-0.190033283
NR_037946	HNRNPUL2-BSCL2	0.01052969	0.041505611	-0.189893567
NM_003334	UBA1	0.006998789	0.030176709	-0.189570904
NM_153280	UBA1	0.00726928	0.031109042	-0.189531535
NM_001199184	ATP2C1	0.011721926	0.045233147	-0.18877838
NM_033554	HLA-DPA1	0.009529164	0.038298372	-0.187929947
NM_002122	HLA-DQA1	0.000948725	0.005964306	-0.18776274
NM_014382	ATP2C1	0.012435526	0.04736684	-0.186441753
NM_178335	CCDC50	0.010191261	0.040456013	-0.186204138
NM_002568	PABPC1	0.002631681	0.013778305	-0.182939387
NM_001862	COX5B	0.008636783	0.035533611	-0.181633187
NM_001242524	HLA-DPA1	0.012060288	0.046274446	-0.181234886
NM_006460	HEXIM1	0.003537381	0.017441706	-0.180814658
NM_001749	CAPNS1	0.0107265	0.042107169	-0.179509635
NM_033554	HLA-DPA1	0.012886261	0.048676881	-0.179496298
NM_001003962	CAPNS1	0.010805213	0.042333356	-0.179334321
NM_005216	DDOST	0.007532265	0.031949232	-0.178045001
NM_005165	ALDOC	0.012847881	0.048575123	-0.175617231
NM_019111	HLA-DRA	0.00238923	0.01274928	-0.173674567
NM_001155	ANXA6	0.003399995	0.016898752	-0.171912519
NM_052862	RCSD1	0.003665682	0.017945726	-0.171405609
NM_001009999	KDM1A	0.010348359	0.04094836	-0.168229775
NM_005051	QARS	0.01086094	0.042521577	-0.168136148
NM_015013	KDM1A	0.010238814	0.040606812	-0.167802025
NM_002124	HLA-DRB1	0.010676885	0.041939913	-0.166114294
NM_001243965	HLA-DRB1	0.010569452	0.041623694	-0.166006934
NM_030810	TXNDC5	0.002224222	0.012041758	-0.165338454
NM_001193544	ANXA6	0.005959876	0.026387015	-0.162009334
NM_006098	GNB2L1	0.011824719	0.045576545	-0.160999044
NR_037616	TXNDC5	0.004467484	0.021013015	-0.158829788
NM_001145549	TXNDC5	0.004497718	0.021135151	-0.158448295
NM_019111	HLA-DRA	0.008381413	0.03471365	-0.153309443
NR_003662	RPSAP58	0.006115955	0.026961553	-0.152898904